SCIENTIFIC AMERICAN

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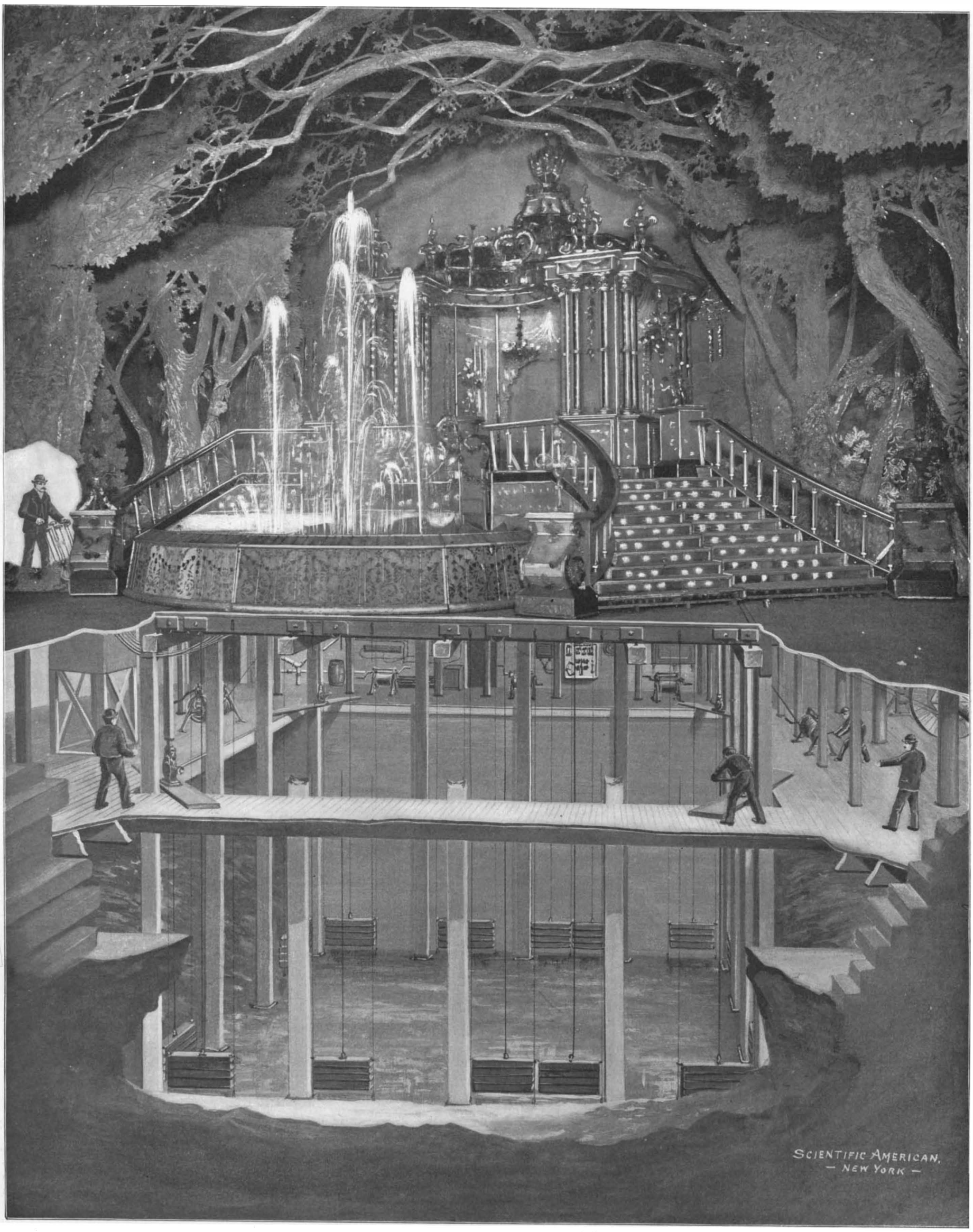
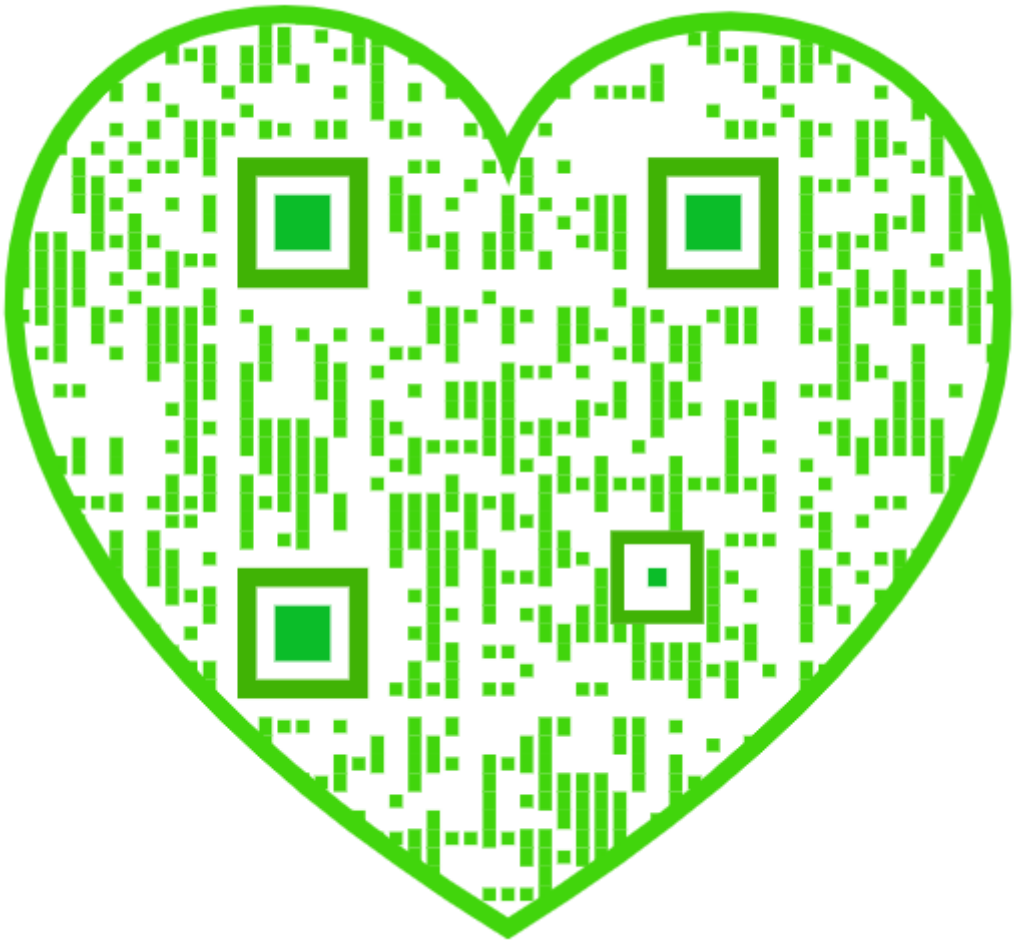
Vol. LXXXVI.—No. 14. ESTABLISHED 1845. | NEW YORK, APRIL 5 1902. | $3.00 A YEAR. 8 CENTS A COPY



THE GLASS PALACE AND ILLUMINATED FOUNTAIN IN THE THEATRICAL PRODUCTION "BEAUTY AND THE BEAST."—[See page 238.]



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ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Monthly (Established 1885)..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, APRIL 5, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

RECENT FIRE LOSSES IN AMERICA.

Is it not strange that with our cities equipped with fire departments that are universally conceded to be the best in the world the fire losses should reach such enormous totals as they sometimes do? Thus, a compilation by The New York Journal of Commerce shows that during the month of February the fire loss of the United States and Canada reached the stupendous total of $21,010,500. It is true, February was the month in which the great Waterbury and Paterson fires occurred; but even the loss by these two conflagrations combined, if deducted from the total, leaves a fire loss for a single month of $15,000,000. It is evident that we must look elsewhere than to the equipment and efficiency of the fire departments for an explanation of these totals; and the explanation is to be found undoubtedly in the very lax building laws which have obtained in the past, especially in regard to fireproof construction. Only as adequate laws are drawn up and enforced can we expect the fire losses to be brought down until they bear a reasonable proportion to the property under insurance. An analysis of these losses would doubtless show that only a small percentage of them occurred in buildings that were built according to the accepted methods of fireproofing.

EAST RIVER BRIDGE NO. 3.

The first important step in the actual work of construction of the new East River Bridge, which is to be built not far to the eastward of the present Brooklyn Bridge, and which has hitherto been known officially as Bridge No. 3, was recently taken when the first caisson was towed into position at the site of the pier off Washington Street. 'Like those which were sunk to carry the towers of the new East River Bridge, this caisson is built of timber; but while each of those towers is carried on two separate caissons the new towers will be founded upon single caissons. The one in question is a truly gigantic affair as caissons go, the largest in the world, in fact, being 78 feet wide by 144 feet in length and 60 feet in depth. It was constructed upon the shores of the East River in Harlem, and when it was afloat it drew no less than 14 feet of water. It took four tugs to tow the caisson down the river, and in some places, where the currents made navigation more difficult, as many as seven tugs were required. Now that the caisson is in place, the work of sinking it through the overlying material of the river until it rests everywhere on solid rock will go forward continuously night and day. It is expected that it will be down to grade in about ninety days' time.

A HEALTHY DECADENCE.

The wave of pessimism which is passing over Great Britain as the result of her feeling the first phases of that stress of competition, which was bound ultimately to come upon her, does not seem to be warranted by the statistical facts of the last Board of Trade returns, according to which the foreign commerce of the United Kingdom during 1901 amounted to the enormous total of $4,353,585,000. The foreign trade of Great Britain is $750,000,000 greater than it was six years ago, and is now equal to $105 per head of population. These figures suggest that the "antiquated" British methods, of which we have heard so much recently in the public press, cannot be so altogether futile, especially when we consider that her foreign trade last year was more than double that of the United States. The total foreign commerce is made up as follows: Imports, $2,611,195,000; exports, $1,402,495,000; and re-exports, of foreign and colonial merchandise, $338,233,000. If to these figures be added a vast sum of $7,500,000,000, representing the total over-sea trade of the British Empire, we cannot but feel that the long-deferred decadence is at least a healthy and vigorous one.

SAFE EXPLOSIVES.

The recent disastrous explosion on the Subway gives particular interest to the test of a new blasting agent, joveite, which has just been carried out in the presence of the Chief of the Fire Department, a representative of the Bureau of Combustibles, the General Superintendent of the Subway Construction Company, and other engineers and specialists. The test was carried out at the Jerome Park reservoir, which is now under construction by Mr. McDonald the contractor of the Subway. The powder is a picric acid compound, which is so treated in the process of manufacture as to render it insensitive to shock and only capable of being detonated by a fulminate. In the tests a box of the explosive, which latter is a yellow odorless substance resembling coarse corn meal in appearance, was tested by hammering a number of 6-inch spikes down into the material. In another test a mass of the blasting agent was shot at several times with a revolver. A 50-pound case was placed on an anvil, and a 250-pound weight dropped upon it from a height of 40 feet; though the friction of the impact set the joveite on fire, there was no detonation. On the other hand, the power of the explosive was shown by placing about twice the amount of an ordinary shotgun charge in a mortar beneath a 62-pound weight, and detonating the same, with the result that the projectile was thrown 300 feet into the air. Not many days later a test of Masurite (another blasting agent) was held, and we understand that the same feature of insensitiveness to shock was manifested. There is no question that this class of explosives is eminently suited to blasting operations in the heart of the city, such as are now being carried on at the Subway, provided, of course, that these compounds prove to be perfectly stable, or not liable to chemical decomposition. A so-called "safety" explosive in a decomposed condition would be about the most dangerous article in existence; for "familiarity always breeds contempt," and the decomposed explosive would receive a freedom of handling which dynamite, with its acknowledged greater sensitiveness, would never be subjected to. If a perfectly stable, insensitive blasting agent can be produced, one that will keep indefinitely, we think the Subway contractors should give it a thorough trial.

THE WORK OF THE WEATHER BUREAU IN 1901.

The excellent service rendered by the Weather Bureau during the past year has been recorded by its chief in the report which he has just submitted to the Secretary of the Interior. The Bureau and its staff have time and time again demonstrated their usefulness, notably during the Galveston hurricane, one of the most destructive tornadoes that ever swept the country.

The work of the year has been more or less a continuation of that previously begun. Better means for obtaining ocean forecasts by international co-operation have been obtained. Three additional forecasting districts have been established. The last appropriation bill passed by Congress provides for three additional forecast officials, who are to take charge of these districts. The line of work pursued in previous years by the climate and crop service divisions was continued. Unfortunately, few persons realize how complete is the system adopted by the Bureau for the dissemination of information to the crop growers. Paid and skillful officials to the number of 1,200 outside of Washington report on all matters concerning weather, crops, climate, and statistics; at the central office in Washington 200 officials alone are employed; 180 fully equipped meteorological stations are centered over the United States and its dependencies, each conducted by trained officials; and in every State and Territory a central observatory is located, to which all subordinate officers in the State report, and to which all volunteers give their information. The telegraph circuits of the Bureau have been equipped with ingenious devices for the rapid distribution of daily meteorological reports. Temperature and rainfall reporters telegraph their data daily from the growing fields to certain cotton, corn and wheat centers. Storm-warning display men are stationed along the Atlantic, Gulf and Pacific coasts and in the lake region. A Weather Bureau man is to be found on the floor of every important board of trade or exchange in the country. He publishes weather and crop information, and chart, the weather report on a large map.

Particular attention has been given to the distribution of forecasts by means of the rural delivery. There are now 365 centers. Some 42,000 families in the farming districts are supplied with the latest weather protection. The rural free delivery places the frost and cold-wave warnings in the hands of those who can make the most valuable use of them.

In wireless telegraphy the Bureau has endeavored to secure a more powerful transmitter, a sensitive receiver, and a selective means whereby messages can be differentiated. The first of these problems has been successfully solved; the second is nearing a successful solution; and the third, although well demonstrated theoretically, has not been fully tested in practice.

The experiments conducted by the grape growers in France and Italy for the purpose of preventing hailstorms, by the use of explosives fired from especially designed cannon, has attracted the attention of the Bureau. It is the opinion of scientists both in America and Europe that hailstorms cannot be prevented by such means. With the experience of a few years ago with our own rainmakers before it, the Weather Bureau sees no reason for expending thousands of dollars in uselessly cannonading the heavens.

Of the minor work conducted by the Bureau, mention should be made of the installation of sixty new storm-warning towers and of the inauguration of the study of meteorology in the schools and colleges of the country.

COMING AUTOMOBILE ENDURANCE TESTS.

With the advent of spring, the automobilist feels the blood astir in his veins, and is seized with the desire to be out on the roads, testing and enjoying his new means of locomotion. As a result of this, there are to be several endurance runs. The first of them will take place on Long Island on the 26th of this month, under the direction of the Long Island Automobile Club. Steam vehicles, which were last year barred from this run on account of the non-stop conditions, will this year be permitted to enter, since they will be allowed to stop every 20 miles to take on water and fuel. Electric vehicles may be entered under similar conditions. Gasoline machines will be expected to make the 100 miles without a stop, including the climbing of a long hill at Roslyn. Carriages that go through successfully, without a penalized stop, at an average speed of between 8 and 15 miles an hour, will be awarded first-class certificates. The speed must be reduced to 8 miles an hour in passing through towns and villages, and stops made in compliance with the requirements of public safety will not be charged against a vehicle. The maximum speed limit of 15 miles an hour must at no time be exceeded. All gasoline and steam vehicles will have their fuel consumption accurately measured.

The Automobile Club of America will make a 100-mile endurance run from New York to Southport, Ct., and return, on May 30. The contest will be open to steam, gasoline and electric vehicles. The steam carriages will be allowed three stops for supplies. The electric vehicles will be divided into three classes, viz., carriages making the entire 100 miles without a change of battery, carriages in which a change of battery is made at the 50-mile point, and carriages in which batteries are changed twice at one-third and two-thirds of the distance. These are the first endurance runs in which there has been a class for electric vehicles, and it is to be hoped that the manufacturers will take advantage of it to show what their machines can do on long-distance work; for although American-made electrics are the finest in the world, no attempt has yet been made to show what they can do in long cross-country runs. England and France, thus far, hold the record in this respect. To obtain a first-class certificate, vehicles must not fall below an average speed of 8 miles an hour, or at any time exceed the speed limit, which is 15 miles an hour.

A motor bicycle endurance run from Boston to New York will be made by the Metropole Cycle Club of the former city. It is intended to take two days to cover the 200 miles, and the start will be made from Boston on the morning of July 4. The bicycles will be graded in classes according to the horse power of the machines, and they will be run under practically the same rules that obtain in automobile endurance tests. This will be a very interesting event, and will do much toward advancing the motor bicycle in popular favor and showing what it is capable of accomplishing in making a long-distance journey over roads that are not of the best.

Many of the other automobile clubs are planning race meets for Decoration Day. Among others, the newly-formed Hartford Club will have races at Charter Oak Park, in which Fournier is expected to contest. The Springfield, Mass., and the Indianapolis, Ind., clubs are also actively engaged in perfecting their plans for similar meets.

The Automobile Club of America expects to have another 500-mile endurance run in the autumn. The route followed this time will be from New York to Boston and return.

The series of events which are to be held in France this season at Nice promise to be of unusual interest. The principal event is the Nice-Abbazia race. As the necessary permission could not be obtained from the French authorities this year it was decided to hold the annual race in Italy, starting from Nice as tourists until the frontier is reached. The terminal point, Abbazia, is in fact in Austria. Accordingly the Austrian as well as the Italian clubs are greatly interested in the affair, and the King of Roumania, the Grand Duke of Luxemburg, the Prince of Austria, and other persons of eminence who are stopping at the seaside re-

sort of Abbazia will give the chauffeurs a cordial reception. The route will be covered in several stages. Starting on the 8th of April, a run will be made from Nice to Turin, and during the following days from Turin to Padua, and Padua to Abbazia, from where the chauffeurs will have an opportunity to visit Venice, which is not far off. Venice cannot be conveniently reached by automobile on account of the routes. A nautical fête will be held at Fiume, and another at Abbazia. The same route will be followed on the return trip, and at Nice an exposition will be held in which the racers will figure. Another feature is the touring race. A caravan of chauffeurs started from Paris about the first of April to travel via Dijon and Lyons to Marseilles and thence to Nice, where it will join the racers and follow them as tourists over the same route. The touring vehicles will in general be the standard types of automobiles, but a De Dietrich omnibus which holds eight persons has been entered and is expected to cover the whole Paris-Nice-Abbazia and return route.

The Paris-Vienna race, which it was hoped could be run off this summer, has had to be abandoned owing to the failure to obtain permission to run through Bavaria. When the Swiss authorities forbade the race to be run through their country, it was hoped the route could be planned through Bavaria; but since this was the only other way, and as permission could not be obtained, and the race has of necessity been called off. It is hoped that next year a Paris-St. Petersburg race can be arranged.

SCIENTIFIC NOMENCLATURE.

A scientist who discovers a new chemical element, a planet that has managed to elude the searching telescope, or a plant or animal unknown to the world, has the right to name the object discovered. To be sure the privilege is merited, but what racking of brains it often entails was recently proven by the difficulty which Charlois of Nice experienced in baptizing the thirty-four planetoids which he had discovered. When Piazzi on New Year's day of the nineteenth century saw the first of these small planets, it was easy enough to follow the old rule of giving to celestial bodies the names of the Greek and Roman deities. For a long time the catalogue of mythological personages was quite capable of supplying the necessary names. But when celestial photography relieved the astronomer of much of the labor of telescopic observation, and the planetoids began to be numbered by hundreds, the list of mythological names was soon exhausted. Following the example of the Romans, Charlois personified the virtues, and thus created Amicitia, Fiducia, Modestia, Gratia, and Patientia. When he had no more virtues to fall back upon, he started with the city gods of those towns in which observatories are located, and was finally compelled to adopt proper names such as Ursula, Cornelia, Malusina. Charlois did not even shrink from giving some of his astronomical children the names of Charybdis, Industria, and Geometria. Not so long ago, Dr. Schwassmann, of Heidelberg, who in conjunction with Prof. Wolf discovered six planets, used the names Ella, Patricia, Photographia, Æternitas, Hamburga, and Mathesis.

At one time it was suggested that the planetoids be simply designated by number. Had that suggestion been followed, every one would immediately know the order of discovery.

When the spectroscope revealed the existence of a host of new chemical elements, some patriotic but ill-advised chemist found it necessary to nationalize the new bodies, with the result that our chemical nomenclature has been enlarged by the names Gallium, Germanium, Skandium, and Polonium.

When we enter the field of botany, the baptismal task becomes positively appaling. The efforts expended by Linnæus or Ehrenburg in finding names for thousands of new organisms must have been enormous. Even Haeckel had to coin names for a few thousand organisms which he was the first to describe.

When it becomes necessary to rechristen a botanical species which has been divided into several new species because later research proves it to be heterogeneous, and which bears the name of its discoverer, baptizing becomes a rather puzzling matter. Out of scientific piety the later investigator must give the first discoverer credit, and yet he must do himself justice. In such a case anagrams are sometimes formed. From the species *Hermannia*, for example, discovered by Paul Hermann, a small group is separated and called *Mahernia;* and the species *Malpighi*, named for a famous old botanist, supplied the species *Galphimia*—a name which would deceive the most skilled etymologist who tried to trace its derivation without knowing its antecedents. Often by some capricious accident an anagram receives a Greek tone. Urobenus, for example, conceals the name of the botanist Bourne (Bournerus).

Cassini used the anagrammatic method, not for reasons of scientific piety, but merely because he liked it. From the old species of *Filago* he created four new species which he called *Logfia*, *Gifola*, *Iglofa*, and *Ogilfa*. Adanson is said to have resorted to the method of throwing dice to coin a new name. No doubt each die bore at least two vowels; otherwise the names would have been charged with consonants to such an extent that only a Russian or Hungarian could pronounce them.

A BRIEF HISTORY OF STREET GAS.

The beginning of the last century was marked by an invention which, although of no apparent promise at first, did much to change our methods of illumination. The invention in question was the industrial production of gas from vegetable and mineral fuels, and was the culmination of a series of investigations instituted by the French engineer Philippe Lebon d'Hambersin, whose name is now almost forgotten.

Combustible gases were known before Lebon's day. The existence of gaseous fluids was known, even to the ancients, notably atmospheric air. Other gases were recognized by their effects upon various bodies. Carbon dioxide, for example, was a familiar gas by reason of its destructive effects; combustible marsh gas was also known. Coal-mining, with which mankind has been more or less familiar for thousands of years, undoubtedly revealed combustible gases; but since there were no means of ascertaining the chemical nature of these gases, they were simply regarded as modifications of ordinary air, which had acquired new properties.

Van Helmont was the first who discovered the existence of gaseous fluids of constant chemical composition —fluids which were to be sharply distinguished from ordinary air, and which he called "gases." The name applied by Van Helmont to these fluids is still used to-day in modern chemistry. In the Philosophical Transactions of 1667, a spring in the vicinity of Wigan, Lancashire, is described from which inflammable air arose. In the volume of the Transactions for 1733 a gas is mentioned, which was produced in a coal mine in Cumberland, and which was collected in a vessel in such a manner that it could be ignited by means of a burner-pipe.

Nothing more was done to ascertain the nature of these combustible gases until Dr. John Clayton distilled hard coal in a closed vessel and obtained a black oil and a constant gas, which latter he collected separately in a closed vessel, from which burner-tubes led. An account of these experiments may be found in the Philosophical Transactions for 1739.

After a series of experiments with vegetable material, Dr. Hales found that fully a third of a distillate of oil was lost in the form of an inflammable vapor.

Watson, Bishop of Llandaff in 1767, studied the nature of this vapor and of the gaseous products of the distillation of coal. He found that the volatile product could be ignited, not only as it was discharged from the distilling apparatus, but that the inflammable properties were preserved even after the gas passed through water and through two long coils of pipe Watson's constant products were obtained from ammoniacal fluids, from a viscid, tar-like oil, and a spongy coal which we now call coke. These were only laboratory experiments, for the purpose of determining the constituents of the oil. No one dreamed of practically using the volatile inflammable products.

The first investigator who laid claim to the discovery of illuminating gas was undoubtedly Philippe Lebon. The idea of using carbureted hydrogen gas for illuminating purposes seems to have had its birth in Paris in 1786. But the laboratory experiments made in England and France up to the year 1799 yielded no practical results. In the year VIII. of the Republic (1799) Philippe Lebon, who at that time was well known for his improvements in steam engines, described an invention for the utilization of inflammable gas as an illuminant. Lebon generated his carbureted hydrogen gas by distilling wood, obtaining as a by-product tar, wood alcohol and all the other substances found in a retort after the destructive distillation of vegetable material. The first carbureted hydrogen apparatus was installed at Havre for the illumination of the lighthouse. In the same year Lebon took out a patent on his invention. He exhibited his apparatus at his house between 1799 and 1802. The odor of illuminating gas, when it first comes out of the retort, is by no means agreeable. Frenchmen, therefore, immediately condemned the new system of illumination.

In order to overcome this objection as well as others, and to make the invention of Lebon more practicable, it was necessary to wash the gas. Had Lebon not died in the midst of his labors, he would undoubtedly have devised a method of ridding the vapors of some of their impurities. His widow in the year X of the Republic received a patent on an improved process. She died soon after her husband.

Lebon's memorial was published in 1801, and bore the title "Thermo Lamps or Stoves, which Heat and Light Cheaply and which generate Power, useful for all Machines." Lebon's invention was developed in England, and was first practically utilized in that country by an engineer named Murdoch, in Soho, near Birmingham, at the large factory of James Watt, the inventor of the steam engine. In 1802 the entire façade of this large building was illuminated by gas in honor of the peace of Amiens. Shortly after this event a German named Winsor, who had translated Lebon's memorial into German, came to London, collaborated with Murdoch, and received from King George the exclusive privilege of lighting London by gas. On July 16, 1816, his privilege was confirmed by Parliament; and by 1823 England had adopted gas.

After Winsor had assured himself of the success of gas illumination in England, he went to France in 1815, rented an establishment in the Passage des Panoramas, and in a short time had the whole Passage lit by gas as well as the Palais Royal. After these successes, Winsor succeeded in founding a company, which was, however, by no means successful. Other companies soon followed, and in a short time gas became one of the most widely used illuminants.

Lebon was born in Brachay (Departement Haute Marne) in May, 1767. He studied in Paris, and graduated from the Ecole des Ponts et Chaussées. As we have already remarked, his first scientific successes were achieved in the field of steam engineering. His improved steam engine received a prize of 2,000 livres in 1792. Lebon was murdered on December 2, 1804, under circumstances that have never been cleared up.

SCIENCE NOTES.

The firm of E. I. Du Pont de Nemours & Co. is celebrating the centennial anniversary of the establishment of its powder industry in the valley of the Brandywine near Wilmington, Del., where it is still in operation. In recognition of the event the firm is issuing a brochure giving a sketch of the works' very interesting history.

The University of Pennsylvania recently came into possession of what is regarded as the oldest piece of writing in the world. It is not a manuscript, but a fragment of a vase which was broken in the raid on the ancient city of Nippur. The inscription is in picture writing, and indicates that the piece dates back to forty-five hundred years before the Christian era.

Dr. J. H. T. Stempel, of New York, who has lived in Manila for a considerable period of time during Spanish rule, has prepared the first Tagalog grammar and a complete English-Tagalog and Tagalog-English dictionary. The manuscript is about ready for the press. Dr. Stempel has embodied in his work not only the Malayan roots of the various Philippine dialects, but also Spanish derivatives that have been adopted by the natives during the Spanish rule of three centuries. The book will probably be very useful to American officials and military men whom duty calls to the Philippine Islands.

MM. Berthelot and André state that the intensity of the acid reaction of the sap is not a certain test for the amount of acid present, the proportion which exists in the form of neutral salts being very variable. The sap of plants has most commonly an acid reaction. According to M. Astruc the maximum amount of acid is always found in the youngest part of the plant; it it connected with the vigor of growth and the activity of cell division. Thus the acidity of the stem increases toward the apex. The leaves contain more acid than the stem, and the largest amount is near the zone of most active growth. The acidity of the flower decreases from the bud-condition up to the period of complete expansion.—Comptes Rendus.

The stunted trees and shrubs of the Japanese have been the wonder and envy of gardeners the world over. But a German chemist now comes along and does something which even the Japanese could hardly be expected to do. He has prepared a fluid that has the power, when injected into the tissues of a plant, near its roots, of anesthizing the plant. As a result of this injection, the plant does not die, but stops growing, maintaining its fresh, green appearance, though its vitality is apparently suspended. Changes in temperature seem in nowise to affect the foliage, for the plant blooms in the open as well as in the most carefully constructed hothouse. As might be expected, the composition of the fluid is shrouded in the greatest mystery.

While M. Santos-Dumont was inflating the balloon of his No. 6 airship at Monaco, he was commanded by the authorities to cease immediately the process of hydrogen making, on account of the extraordinary effect that the drainage of refuse acids and chemicals into the bay was having on the water, which had turned a brilliant orange, and which it was feared might have an injurious effect on residents near the sea front, besides poisoning the fish. Subsequent investigations of the curious phenomenon, however, proved that the refuse sulphates running from the Dumont gashouse into the sea had, on contact with the chloride of sodium or common salt of the ocean, precipitated enormous quantities of oxide of iron. This pure rust had dyed the waters and the shore a most brilliant orange carmine, but except for this no harm was done. Beyond acting as a tonic for the fish, the rust was absolutely innocuous, and the work of inflation was forthwith resumed.

THE SOUTH WIDENING HER FIELD OF AGRICULTURE.

BY FREDERICK MOORE.

Prof. H. W. Wiley, chief chemist of the Department of Agriculture, returned recently from an extended tour through the Gulf States. The Professor was the guest of the southern railroads, and the object of his expedition was to meet the members of the various southern agricultural and grange associations, some of which were then in session. The conclusions drawn from the trip, as given in a report on his return, can be summed up about as follows:

The South is fully alive to the advantages of scientific agriculture. Cotton is no longer king everywhere along the South Atlantic and Gulf. Georgia and Alabama are now producing profitable sugar crops. Dairy products are being widely exported through all the Southern shipping ports. Everywhere the enterprising farmer of the far South is suiting his crops to his soil, cultivating his farms to improve them, not to impoverish them, and widening the field of his activities, so that one interest aids another, to the vast betterment of the whole.

Through central Georgia sugar cane grows almost as far north as Macon. Cassava, one of the new crops of the South, is being produced in large quantities. The sight of these two crops and the growths of sweet potatoes, which there abound, show plainly the prosperous condition of agriculture in that State.

Thomasville and Cairo, Georgia, are the great centers of the sirup industry. From Cairo the annual export amounts to 15,000 barrels. There American syrup-making has reached its best development, and the business has increased ten-fold in the past five years. The American consumer is tired of syrups made up largely of glucose and sugar waste. To meet the new demand the Georgia consumer has taken to producing a syrup made from the whole cane—what was known formerly as "cracker syrup." It is the best cane syrup produced, altogether pure and wholesome.

Hitherto sugar cane could not be grown in Georgia with sufficient profit to encourage competition with the growers of the tropics. Now, with a developed cane, particularly suited to that soil, the planter not only grows cane at a profit, but raises from 30 to 35 tons to the acre, harvests his crop in eight months instead of fourteen, turns out a product fully equal in flavor to that of the hotter countries, and gets one-sixth of the entire cane weight in sugar.

Cassava, sweet potatoes and cane are proving more profitable in southern Alabama than cotton. This is the first successful departure from cotton-growing the section has ever made. Previously the shift had been to truck farming, and the effort had failed because the distributing markets are too far away. But the new products do not require immediate delivery. Cane is put to its usual uses, and the bagasse fed to cattle. This feed produces the very manure fertilizer the soil needs, so that dairy and farm interests both reap a second benefit from the sugar interests in the State. Sweet potatoes are a staple and valuable crop. They find a ready market at all seasons. But now the farmer in sweet potatoes raises not only a good potato for shipment and consumption, but also a rich, sweet yam for conversion into starch.

Cassava, however, is the real starch plant. It is destined to displace the potato of the North as a basis for food starches. Arrowroot, tapioca and starch puddings are constant and growing articles of food, and are all made from starch. The South can supply a better starch for the purposes of such manufacture than the maker has been able, heretofore, to obtain. For laundry purposes cassava starch is at least as good as any other kind.

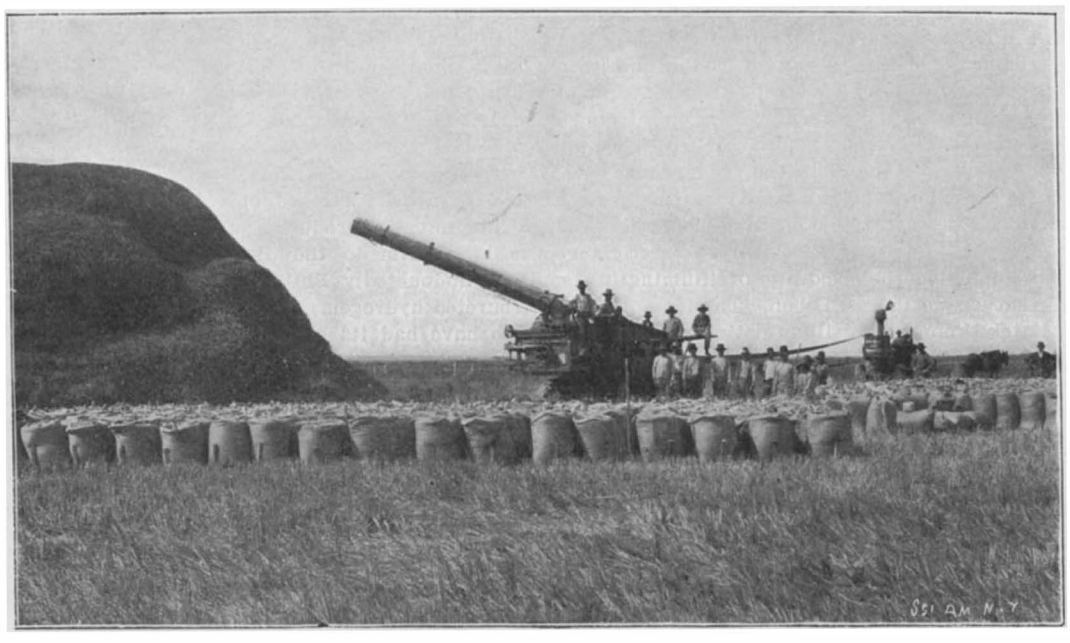
In all these States the field of agricultural labor has noticeably widened. The velvet bean is now grown and used for hay. Alfalfa, as a southern crop, is rising to an importance scarcely less than it has attained in the West. Beggar weed, formerly considered a pest, has been found to produce good hay, and it still grows as readily as when the farmers fought so vigorously to exterminate it. Sorghum, grown as a forage plant, yields three or four crops a year, and one acre is thus able to support more cattle than a considerably larger number of acres devoted to ordinary grazing. Hereford, Devon and Jersey cattle are found everywhere—registered stock of the finest breed. Grade cattle or cattle bred from the registered stock, and the native beef, is supplementing the old, low-grade beef formerly so much in evidence. Milk and butter are being produced and marketed in great quantities, products unknown to the section eight years ago.

Florida is recovering splendidly from the disastrous freeze of five or six years ago. The crop of oranges last season amounted to 2,000,000 boxes. The year after the freeze it was 500,000. Within a few years the output will reach 5,000,000. This fruit is, of course, of the very highest grade. The Florida seedless orange has now a market importance second to no other.

While cotton and sugar are still the great staples of Louisiana, other products, especially rice, have taken prominent places. What was, a decade of years ago, an arid southwest in the Pelican State and southeast of the State of Texas, producing little else than pine lumber, is now a busy, thriving rice section, with more life to it than any other farming section of the South. The numerous new ports and harbors along the Gulf coast are a decided aid to the advancement of its agricultural interests.

Wherever you go you will find that the South is alive in every sense of the word, and there is a spirit of confidence that augurs well for the future. Cotton, though still the great product of the section and yearly increasing in quantity there produced, is now simply a backbone, where it used to be the whole frame of the South. The farmer no longer watches the cotton quotations with the apprehension of a man with all his eggs in one basket. His income has not only increased greatly, but it is destined to increase more and more, and to become more reliable as his present agricultural methods of diversifying his crops continue and advance.

A GEORGIA COTTON FIELD.



THRESHING RICE IN TEXAS.

Preparation of Tantalum in the Electric Furnace.

M. Henri Moissan has lately succeeded in obtaining the metal tantalum by reducing tantalic acid with powdered carbon in the electric furnace. This is the first time that the metal has been obtained in the fused state. Some experimenters have produced it in the powdered form, more or less pure, but its properties have been but little studied up to the present. M. Moissan starts with the fluotantalate of potassium, which he obtains from the mineral niobite. He decomposes this with sulphuric acid and obtains tantalic acid, which is then calcined. Tantalic acid has been hitherto regarded as infusible and non-reducible by carbon, but the experimenter has succeeded in reducing it in the electric furnace and obtains the metal in a nearly pure state. To this end the tantalic acid is agglomerated into cylinders with sugar-charcoal and after calcining is placed in a graphite crucible which is heated in the electric furnace. The temperature should be very high in order to melt the metal after it has been reduced. After heating for 10 minutes with a current of 800 volts and 60 amperes, the metal is separated in a fused state, and upon cooling has the appearance of a brilliant metallic mass with a crystalline fracture. It is nearly pure and in some cases contains only 0.5 per cent of carbon. The cast metal is quite hard and will easily scratch glass and quartz. It is not fusible in the oxy-hydrogen blowpipe, but in this case is transformed into tantalic acid. To melt it in the electric furnace requires the use of a powerful arc. The density of tantalum has been found to be 12.79, while the powdered specimens obtained by Berzelius and Rose showed 10.08 and 10.78 respectively. The metal when reduced to powder takes fire in an atmosphere of fluorine at the ordinary temperature and gives off abundant vapors, which when condensed on a cold surface give a fluoride of the metal. In a current of chlorine the metal is attacked but slowly at 150 deg. C., but on reaching 250 deg. a combination is produced with brilliant incandescence, and a chloride of tantalum sublimes in long orange-yellow needles. This chloride is very fusible and will volatilize in an atmosphere of chlorine without decomposition. Bromine may be distilled over the powder of tantalum without giving a reaction, but at low redness it commences to give a yellow sublimate which increases at a higher temperature. The vapor of iodine does not react at 600 deg. C. If the metal is placed in a current of dry oxygen and heated to 600 deg. C. it takes fire and continues to burn with a lively combustion. No appreciable effect is produced when heated in nitrogen, and phosphorus, arsenic and antimony seem to have no action upon it. Gaseous hydrochloric acid attacks the metal and produces a white sublimate whose color becomes darker as the temperature rises. Ammonia gas is decomposed by powdered tantalum at a low red heat, and the metal darkens in color without changing weight. Sulphurous acid is reduced by the metal at 500 deg. C., giving an abundant deposit of sulphur and an oxide of tantalum. Compounds rich in oxygen, like bi-oxide of manganese, reduce the metal with incandescence. When lead oxide is heated with the metal there results a black spongy mass containing globules of melted lead. Tantalum is insoluble in aqua regia, but like silicon and niobium is easily attacked by nitro-hydrofluoric acid. These various reactions show that tantalum has reducing properties which class it rather as a metalloid than a metal proper. In most cases its action closely resembles that of niobium, but it is less energetic.

In the Tapestry Court of the Victoria and Albert Museum, a splendid example of late fourteenth century tapestry work is now to be seen. The tapestry comes from Hardwick Hall, the Duke of Devonshire's Chesterfield seat, where it has lain for years in a rather sorry condition. The material has been skillfuly prepared and pieced together, so that it now represents what it once was, a picture about 35 feet in length illustrating some sports of the period.

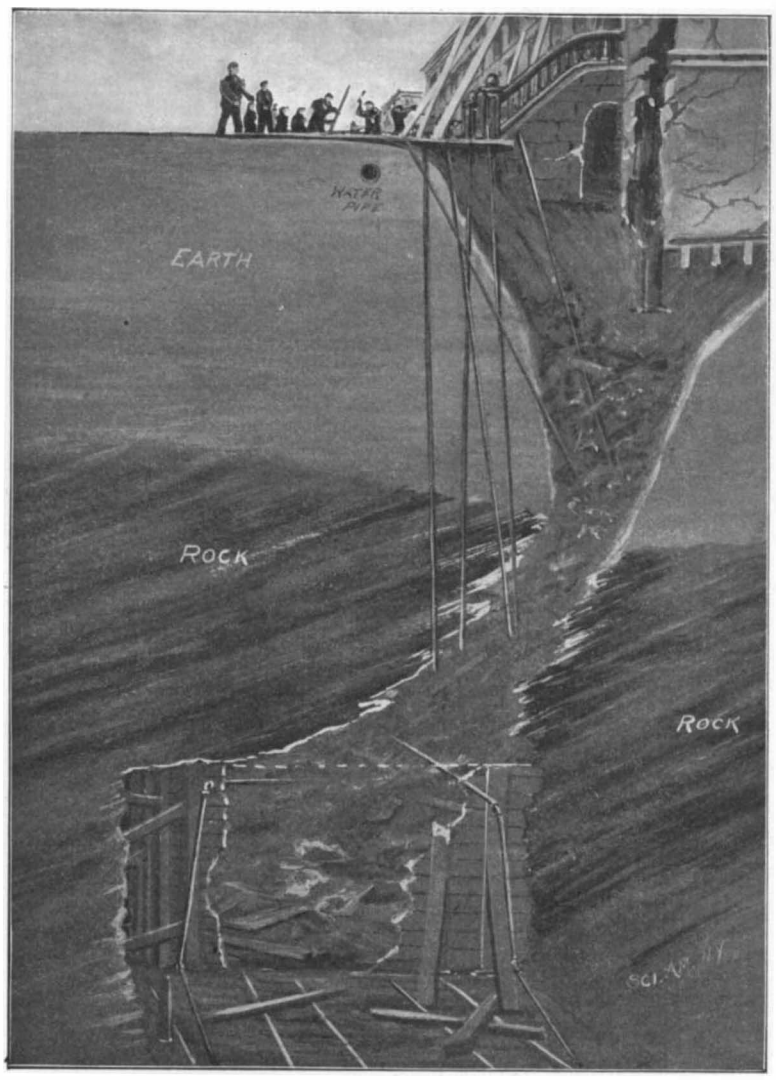
THE PARK AVENUE TUNNEL CAVE-IN.

The preliminary borings which were made along the route of the entire subway during the survey before construction, showed that the tunnel between 34th and 42d Streets would be built through a bed of solid rock. The tunnel has been driven through, both on the east and west side of Park Avenue, for this entire distance of 1,800 feet. In some sections, indeed throughout the greater part of it, the blasting has been done to the full section required. The tunnel as thus roughly blasted out is 30 feet in width, 12 feet in height to the springing of the elliptically-arched roof, and 6 feet from the level of the top of walls to the crown of the roof, making a total height inside of 18 feet. Generally speaking, the tunnel was driven in two headings, the lower heading rectangular in cross section, 12 feet in height by 30 feet in width, and the upper heading 6 feet in height to the crown of the elliptically-curved roof. After the tunnel is blasted out to the dimension given above, the floor, sides, and roof are lined with a heavy wall of concrete, and the space between the wall and the irregular surface of the rock, as left by the blasting, is filled in, rendering any caving in of the rock impossible.

Commencing at 34th Street, on the east side, the first 200 feet of the tunnel has been entirely excavated with the exception of the roof, from which about 4 feet have yet to be blasted off. The next 500 feet have been taken out entirely, the concrete side walls are in place, and for about 80 feet of this distance the roof has been turned in. For the next 300 or 400 feet, from about 37th Street to the middle of the block between 38th and 39th Streets, the bottom heading has been taken out, and in the upper heading a maximum depth of 6 feet has yet to be blasted down. It is in this stretch of work that the slide occurred. In the next 200 feet the upper heading, for a depth of 12 feet from the roof down has been taken out, and about 6 feet remain to be blasted away to bring the tunnel down to the grade. The remaining 500 feet to 42d Street has been entirely blasted out, ready for concreting.

The accompanying illustrations include a profile and cross-section and a plan view of the easterly tunnel, at the point where the cave-in occurred, and show very clearly the causes and nature of the trouble and the means taken to remedy it. The bottom of the tunnel is 60 feet below the street surface. The heading at this point is 12 feet in height by 30 feet in width. The distance from the roof of the heading to the street level is, therefore, 48 feet. In general, the solid rock in which the tunnel lies extends nearly to the surface of Park Avenue; but between 37th and 38th Streets there is a depression or basin in the rock, and its surface lies, as indicated in our drawing, about 28 feet below the surface of the street, or about 20 feet above the roof of the tunnel heading. Above the rock lies a mass of what the engineers call earth, that is to say, a loose material consisting of gravel, sand, clay, etc., of a consistency which can be easily excavated by pick and shovel, and which has no natural cohesion to hold it in place.

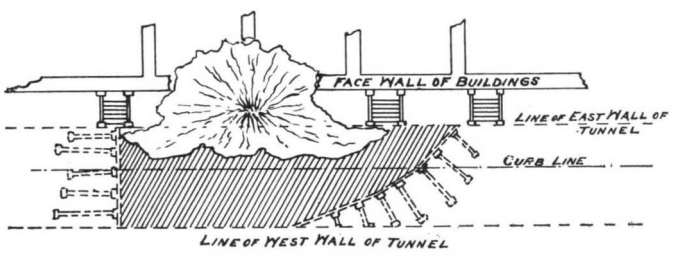
On the Wednesday preceding the day on which the trouble occurred, it was noticed that there were indications of settlement of the rock, and a section of rock measuring about 3 x 6 feet fell through into the tunnel. An examination of the cavity revealed a stratum of decomposed rock, about 4 feet in thickness, which extended diagonally at an angle of about 45 degs. toward the surface. On either side of the rock was a thin layer of greasy decomposed material, somewhat of the nature of soapstone, and the heavy rains and thaws of the winter, aided by a broken water pipe, had thoroughly saturated this material, loosening the 4-foot layer of rock and allowing it to slide bodily into the tunnel. In spite of the endeavors made to stop this sliding by heavy shoring, the timbers were crushed in and a section of the roof 70 feet in length by several feet in width slid into the tunnel. Now, the effect of this section of rock falling in, was, roughly speaking, as though the valve at the bottom of a hopper had been opened, allowing the loose contents above to flow down through the opening thus formed. The loose gravel, sand, earth, etc., poured into the tunnel, forming above the rock layer a crater-like opening of the kind shown in our illustrations. Unfortunately, the foundations of the front wall of the adjoining houses on Park Avenue were resting upon this loose material—a perfectly secure foundation so long as the rock beneath was undisturbed, but, as the event proved, a very unstable one when the rock fell away. The crater extended beneath the foundations of this wall, with the consequence that the areas, front steps, foundation walls and a portion of the brownstone front of the houses affected fell.



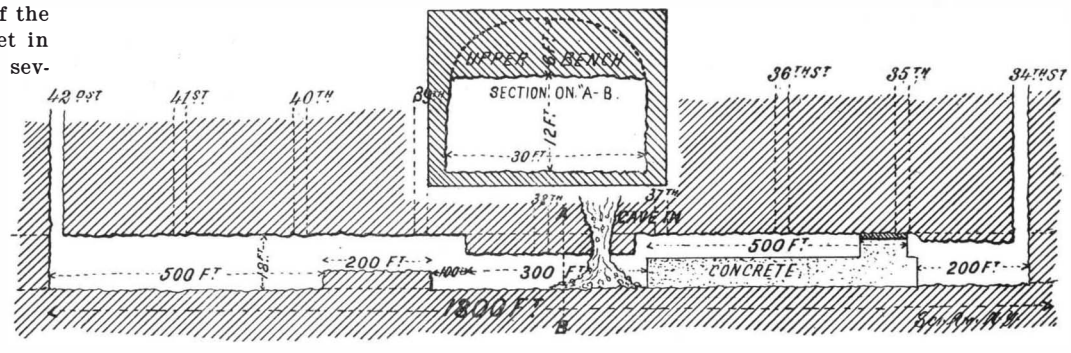
CAVE-IN, SHOWING THE METHOD OF REPAIRS BY BULKHEADING AND GROUTING.

It was first proposed to make an open cut at this point, build a concrete lining for the tunnel, and subsequently filling in above it; but it has now been decided to carry out the repairs in the manner indicated in our sketch, employing a system of grouting which had been used on a previous occasion by Mr. Shaler, the contractor, during repair work in the construction of the new Croton Aqueduct. It is well known to engineers that a mass of loose material (broken rock, gravel, etc.) may be formed into one solid monolith by introducing pipes into it and forcing through them fine "grout," a liquid cement of the proportions of one of sand and one of cement. Driven in under pressure the grout flows throughout the whole mass, filling the interstices, and, in its subsequent solidification, bonding it in one solid monolith.

In applying the principle in the present case, strong bulkheads of timber were built across the tunnel at either end of the slide, and a mass of broken rock and stone was dumped into the crater above; about a dozen pipes were then carried into the interior of the mass, six of them from the surface above and three from the bulkheads at either end, and the grouting driven through them into the material by means of force pumps. No effort is being made to solidify the whole mass of debris in the tunnel, but merely that which lies around the roof in the neighborhood of the break. Similarly, only the material in the lower half of the crater will be thus grouted. When the mass has set, it will be perfectly safe to excavate the tunnel to its full width. The new foundations for the front of the houses that have been injured will be then carried right down to the underlying rock, and, as thus restored, they will be perfectly safe against any further settlement.



PLAN VIEW OF CAVE-IN, SHOWING CRATER AND BULKHEADS.



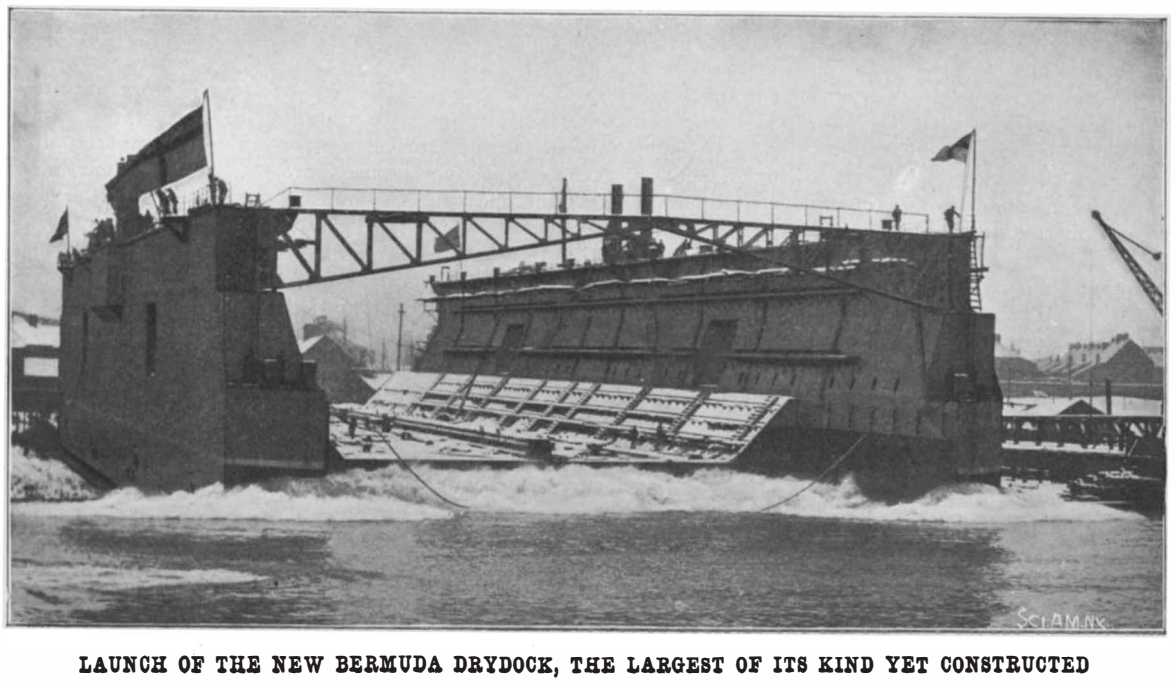
PROFILE OF THE EASTERLY TUNNEL, SHOWING PRESENT STATE OF THE WORK.

THE NEW BERMUDA FLOATING DOCK.

BY H. J. SHEPSTONE.

The new floating dock recently launched on the Tyne, England, from the works of Messrs. C. S. Swan & Hunter, for the use of the British fleet at Bermuda, claims the distinction of being the longest and heaviest dock so far constructed. It has a length over all of 545 feet, while the hull weight of the structure, by which is meant the quantity of steel plates, bars and shapes, rivets, bolts, etc., and all other material essentially necessary to a dock, but not including machinery, timber or any other fittings, is just over 6,500 tons. The great Algiers dock at New Orleans certainly runs it very close, having a length of 525 feet and a hull weight of 5,850 tons.

The dock is to replace the famous old structure at Bermuda which was towed across the Atlantic in 1869, and has now become obsolete, not through age, but through the insufficiency of its dimensions. The length of the old dock was 381 feet



LAUNCH OF THE NEW BERMUDA DRYDOCK, THE LARGEST OF ITS KIND YET CONSTRUCTED

over all, but to obtain its maximum lifting power gates were fitted, which reduced its practical length to 330 feet. Its inside width was 84 feet between side walls, and its lifting power was 8,000 tons, which was sufficient for the ships of the "Bellerophon" class, to lift which it was specially designed, although it was capable of bringing the keel out of the water of vessels up to 10,200 tons, the then heaviest ships of the day, represented by the long fully-rigged line-of-battle ships "Agincourt" and "Minotaur." The present dock is 545 feet long, and having no gates, the length of ship it can take is not restricted; its clear width of entrance between rubbing fenders is 100 feet. Its lifting power up to the pontoon deck level is 15,500 tons, but by utilizing the shallow pound this can be increased to 17,500 tons, and the walls are of a sufficient height to allow of a vessel drawing 32 feet to be taken on 3 feet 6 inches keel blocks.

The present dock is of the type known as the floating graving dock, the invention of Messrs. Clark & Standfield, of Victoria Street, Westminster, London, from whose plans it was built, and who also designed the famous Algiers dock and many other similar structures. It was this firm who designed the Havana dock, which was built and launched by the same firm, Swan & Hunter, in the record time of seven and a half months. Before describing the present structure it is interesting to note the work to be done by the new dock, which is of a somewhat varied nature.

In the first place, it is primarily intended to lift battleships of the largest class, displacing about 15,000 tons on a 27 feet 6 inches draught, and of a length of 390 feet, but with a bearing length of keel of only 343 feet. It has, however, also to deal with long cruisers of the "Terrible" class, of a displacement of 14,200 tons on a 27-foot draught, a length of 500 feet between perpendiculars and a bearing keel of 383 feet; and lastly, it may be called upon to lift the auxiliary steamships of the subsidized mail lines, of which the "Campania" may be taken as a type. This ship in full fighting trim may displace as much as 19,000 tons on a 31-foot draught, but in ordinary docking condition, without full coal supply aboard, her weight will be about 16,500 to 17,000 tons. The length of this type of vessel is 600 feet between perpendiculars, while the bearing length of keel is 502 feet 8 inches.

The following are the principal dimensions of the dock:

Length over all.....	545 feet.
Breadth over all.....	126 feet 2 inches.
Length of end pontoons...	120 feet.
Length of middle pontoon.	300 feet.
Breadth between walls...	100 feet.
Width of pontoons.....	96 feet.
Height of vertical walls...	53 feet 3 inches.
Length of vertical walls..	435 feet.
Thickness of walls.....	13 feet 1 inch.
Lifting power up to deck level	15,500 tons.
Extreme lifting power....	17,500 tons.
Total weight of hull.....	6,500 tons.

The dock itself consists of five portions, comprising three pontoons, which form the main lifting portion of the dock, and two side walls, which, while affording a certain amount of lifting capacity, primarily serve to give the structure stability and to regulate its descent when the pontoons are submerged. The pontoons themselves are of different sizes and form; the center one, which is 300 feet long, is rectangular in shape, but the two terminal ones, which are 120 feet in length, have each 71 feet of their length rectangular, the remainder being finished off in the form of a blunt-nosed point or bow. The sides of the rectangular portion of all the pontoons are built up so as to form a broad altar, standing 12 feet above the dock. The side walls, which are of the same length as the rectangular portion of the pontoons, come along each side of these and are attached there by means of strong steel castings, riveted to their respective outside skins, and connected together by double fishplates and tapered pins.

The pontoons of the dock are further divided into forty pumping divisions, of which thirty-two are absolutely watertight and distinct. The side walls have each eight watertight divisions. All these fifty-six divisions are provided with a separate pipe, each governed by a separate valve. The pipes in the starboard half of the dock are led directly into the main drain in the starboard wall, and all those in the port half to a similar drain in the port wall. These drains are continuous over the whole length of the walls, and the four 16-inch centrifugal pumps in each wall are seated directly on them, so that any one pump can empty all the compartments of its half of dock.

Although the dock is divided into fifty-six divisions, each with its own regulating valve, the working of the whole dock is all done from two central positions on the top of the towers. Here are grouped in the valve houses ordinary signal levers, which by means of rods and cranks connect to the different valves. Each valve house is in direct communication by speaking tubes with its engine rooms, so that the man in charge can manipulate every valve, both water and steam, required for the maneuver of the dock without quitting his station. Each valve is further fitted with an indicator, which shows on top of the valve house exactly which valves are open and which shut, so that the dockmaster can see from any conning position he may take exactly how his craft is being regulated on both sides.

It is interesting here to note the difference between the English and American methods of berthing a ship on a floating structure. The English custom, and also that of Italy and Japan, is to support the armor belt on more or less vertical shores inserted under an angle iron firmly attached to the same. These shores are put in position as the ship is rising, and, as the water recedes, more and more shores are inserted. In the case of the dock under notice, large and heavy altars have been constructed for this purpose. The American method, on the other hand, is to strengthen the bilges of the ironclads with strong bilge docking keels, forming, with the keel proper, a level bottom. No shores, therefore, are required beyond those absolutely necessary to roughly center the vessel, and no great care is required in adjusting the berth, and one set of bilge blocks does for all sizes of vessels. Mr. Lyonel Clark, of Messrs. Clark & Standfield, did not hesitate to express to the writer his preference for the American system. It affords a great saving in weight and quantity of shores, and what is more important a great saving of time, for in the American plan it would be perfectly feasible to dock a vessel completely in the time required to center and adjust her with shores disposed according to English practice.

Although somewhat larger in its outside dimensions, the dock has by no means the lifting power of the Algiers structure. This latter will raise a weight of 18,000 tons up to pontoon level, which could even be increased to 20,000 tons by utilizing the pound, making it the most powerful dock in the world. As already stated, the extreme lifting capacity of the Bermuda dock is 17,500 tons.

This latest equipment to the British navy was successfully launched on the Tyne on Saturday, February 8 last. It was a bitterly cold day, snow falling fast at the time. At the appointed moment the huge craft glided into the water, and was brought to rest within a distance of about 25 feet. It is expected to be completed about the end of April, when it will be brought to Chatham, on the Medway, where it will be thoroughly tested by docking a battleship, after which it will be towed to Bermuda. It is expected to leave England about the end of May.

London, England.

THE GLASS PALACE IN "BEAUTY AND THE BEAST."

In the modern spectacular play it is often necessary to resort to quite original engineering methods in producing startling scenic effects. We illustrate (on our front page) the Crystal Palace and Illuminated Fountain, which is introduced in the Drury Lane production called the "Beauty and the Beast." Most of the pantomimes and other attractions of like nature originate in London, the people of that metropolis being very fond of such displays. "Beauty and the Beast," which is now running at the Broadway Theater, New York, taxes the resources of the theatrical engineer to the utmost. The story of the play is one which does not call for special comment. It deals with the well-known episodes in the fairy tale, in which the daughter of a princess receives gifts from her fairy godmothers, but the hapless child receives also the curse of a malignant witch. The thread of the story runs through the performance, which consists largely of splendid processions and ballets, including an aerial ballet which is a most beautiful and ingenious affair. In the last scene the curtain rises on a glass palace, shown in the front page engraving. In the palace proper and on the steps are grouped the ballet and chorus, and in front is an illuminated fountain. The palace was made in Vienna for the Drury Lane Theater, and is composed of 33,000 pieces of glass. The structure was dismantled and shipped to this country, and was re-erected by Messrs. Klaw & Erlanger for the Broadway Theater. It is lighted by 2,000 incandescent lights of small candle power, two and four, and an immense arc light in the roof. The numerous difficulties connected with the storing of the glass palace when not in use were obviated by simple but ingenious means. An immense pit was blasted out of the rock below the level of the stage cellar, to a depth of 20 feet. Heavy beams were placed at the bottom to bear the weight, and heavy timbers were put in to support the stage proper and its load. Normally, the glass palace rests in this pit, the top projecting almost to the level of the stage, the glass crown which surmounts it being removed. Some ten minutes before the curtain is raised, preparations are begun for raising it. The platform carrying the palace is counterweighted by eight tons of iron. It is raised with the aid of two winches and a bull or purchase wheel, and some seven men are required to raise the platform. The first step is to remove the stage floor, which is run into the flies and hooked up against the rear wall of the theater. Ropes are now let down from the gridiron at the top of the stage by men who operate the bull-wheels. The trussed beams which support the stage are then raised out of view. Signals are given by means of cords which pass through the stage floor. The palace is raised in a few minutes with great ease. The platform on which it rests reaches the stage level, and is brought to exact position by means of screw jacks at the four corners. The palace rests upon rollers. Two winches, shown at the rear, serve to draw the palace back some 15 feet. This is necessary, owing to the fact that the foundation for the rear wall was not of the best, due to veins of water, and it was, therefore, deemed well to sink the pit as far forward as possible. The same winches are used to draw the palace back onto its platform when it is to be lowered. Connection is made with the large switchboard, shown at the rear; the palace also carries its own switchboard. The electric lighting is most interesting. There are 2,000 feet of cable used, and the lighting is accomplished by the Elbright system, which consists of two cables with a wire core capable of being punctured. Each lamp has two pins, one of which passes into each of the two cables. The position of the lamp can be changed at will, it being only necessary to stick in the pins elsewhere and tie with tape. Every part of the palace is brilliantly illuminated, and the effect is one of surpassing beauty.

In addition to the palace proper, there is an illuminated fountain which is also most ingenious. The fountain is carried upon the floor of the palace until the stage level is reached. It is then carried down and placed in front of the balustrade. The various jets are then straightened and tested. Water is admitted from the street, and is divided into seven streams, which in turn furnish seven different rows of jets. Valve wheels with long stems are run through the floor, connecting with valves which control the flow of water to the movable hose. The fountain is illuminated from above, where arc lights are secured to a light-batten, the various colors being produced by rotating disks. By a clever manipulation of the various water jets and movements of the disks, remarkable and beautiful effects are produced.

The flying ballet, which is also a wonderful feature of this play, is the invention of Herr Zschregner, director of the Apollo Theater, Berlin, Germany, and for eight years it has been a standard attraction of the Drury Lane Christmas pantomime. The members of the ballet are all German girls, with the exception of the *première*, who is an English girl. They are all of small, slight figure, and dress in pink-silk tights with black-feather bodices and fronts of white chiffon. They have wings attached, and with their head-dresses they give an idea of something half-human, half bird. Each carries a fluffy, white muff. The costume conceals a corset of leather and iron which incases the entire trunk of the body. At the top of the back is a brass spring bolt adapted to receive a hook secured to a small wire, which passes up to a machine on the gridiron. They are raised and put through various evolutions by means of the manipulation of ropes by men in the wings. From one to three men are required to manipulate the wire for each dancer. At a signal from the director of the troop, the *première* takes the center of the stage, and is followed by the remainder of the bevy. The greatest possible attention is given to marking the place where they are to stand before they are raised, as otherwise a dancer might easily come down upon some of the ballet or chorus. Great care is used in inspecting the apparatus, as the life of everyone of the flying ballet depends upon a wire no larger than a piano wire. The mechanism used in this ballet is carefully guarded, so that no one may see its working. The chief difficulty in this ballet seems to be in finding the true center of gravity of the body. Unlike other ballet dancers, they are hired by the year and not by the engagement or season, as is customary in the theatrical profession. We are indebted to Mr. Claude L. Hagen and to Mr. Bissing of the theater for many courtesies in the preparation of the present article.

The Current Supplement.

The front page of the current Supplement, No. 1370, presents three handsome illustrations of part of the famous Imperial silver service which the Kaiser placed at Prince Henry's disposal for the banquets given on the "Hohenzollern." Prof. Ramsay discourses interestingly on the "Inert Constituents of the Atmosphere." A new use for blast-furnace slag is described in an article on the Berry hydraulic flag-press. The latest of the big locomotives is shown in an admirable illustration. The first part of an interesting treatise by Randolph I. Geare, entitled "From Raft to Steamship," is also presented. The series will be very fully illustrated, and will present graphically the development of navigation from prehistoric times to the present day. To engineers an exhaustive account of turbine engines for passenger ships, with a special reference to the performance of the "King Edward," should prove of value. The much-discussed matter of the three-phase current is treated by Mr. Sydney Woodfield from the standpoint of power and lighting. The Rev. Herbert Thurston has an authoritative article, well illustrated, on the "History of the Rosary in All Countries." The Consular Notes will be found in their customary place.

Electrical Notes.

Electricians have taken no little pride in the splendid electrical display made in the Metropolitan Opera House, New York, in honor of Prince Henry at the gala performance. Some 8,500 extra lamps were required. Not until two days before the performance was the placing of the lamps begun.

The United States Navy Department has placed with the Allgemeine Elektricitaets Gesellschaft an order for a complete outfit of Slaby-Arco wireless telegraphy instruments. Secretary Long has decided to test the various systems of wireless telegraphy which are now in use in this country and abroad, in order to obtain accurate data of their comparative efficiency.

The darkness that has pervaded the Pyramids for thousands of years is now to be dispelled by the electric light. Maspero, the director of the society intrusted with the preservation of Egyptian antiquities, has begun work on the historic temple of Karnak at Thebes. So successful has the result been that the inner passages and catacombs of the great Pyramids are now to be lighted.

Although platinum is now obtainable from ruthrnium, F. Foerster says that it is still too expensive for many commercial uses, such as the electrolysis of salt solutions for making chlorides and soda. For this purpose carbon anodes are employed, although experience has shown that they are in no sense refractory to the electrolyte. Using graphite and molded carbon anodes of different makes for the electrolysis of a salt solution, Foerster found that while graphite showed least waste, it was closely followed in efficiency by the best of the molded carbons. The waste arises in the main from the oxidation of carbon, although there is also a loss due to disintegration.

The experiments upon the Berlin-Zossen high-speed electric railroad have come to an abrupt and unsatisfactory conclusion. It was originally anticipated that the special car built for the purpose would attain a speed of 125 miles an hour. A velocity of only 100 miles an hour was reached, however, and that only for a brief space of time. The effect of this high speed upon the track was so destructive that the attempt to make higher speeds was discontinued. The Berlin-Zossen military track was practically a straight line, so that the experiments, even if successful, would have not substantiated the possibility of running trains safely round sharp curves at these terrific speeds on a two-rail track.

In an article printed in the Physikalische Zeitschrift K. R. Koch states that he has found that lightning conductors, the connections of which have become imperfect through rusting, nevertheless act in an efficient manner during a thunderstorm. In his opinion this phenomenon is due to the oscillating character of a lightning discharge. Electro-magnetic waves have been produced, which act upon the imperfect connections as upon a coherer, restoring the conductivity for a period more or less long. Hitherto lightning has been considered a continual discharge, which often becomes apparently oscillatory by quick repetition. In order to prove his theory experimentally Koch employed a rapidly revolving camera. Unfortunately he has not been able to furnish as complete a proof of his theory as might be desired, for the flashes photographed were all too distant.

An electrical coin or metal detector is a device for which two Pittsburg inventors, Francis E. J. Litot and Adolphus Mayer, have received a patent. The apparatus is designed automatically to test the difference in quantity or quality of metals, and to separate good from bad coin. The principle of the operation consists in the use of primary coils, in inductive relation to which secondary coils are placed. Electromotive forces are thereby produced in the secondary coils, which forces are equal and oppose each other. Inductive force of the primary coils on the secondary coils is varied by the insertion of metallic substances between them having different inductive effects. This variation of the electromotive forces in the secondary coils sets up a current in the relay, producing motion which closes the circuit of the magnet controlling the operating mechanism.

The first practical trial of a new system of the single-rail railroad is to be made at the Crystal Palace, London. The line, which is to be one and a half miles in length, will be worked by electricity. One terminus will be alongside the low-level station of the London and Brighton and South Coast Trunk Railway. Thence it will run up the hill to the Palace Buildings and around the lakes in the grounds. The difference between this system and the prevalent type of mono-rail is that the line is on the ground, and large wheels projecting from the middle of the carriage run on it, while on each side of the carriage there are safety rollers upon guide rails. In the mono-rail the line is elevated, with the carriages overhanging on each side, thus placing the center of gravity below the rail. The experimental railroad will cost $70,000, and the line will be in working order by July.

LIGHTNING ABOVE AND BELOW WATER.

BY PROF. JOHN TROWBRIDGE.

I believe that the following experiments show that lightning never strikes the surface of the sea. In studying the spectrum of water vapor, I have often endeavored to pass powerful sparks to the surface of water, in order to obtain a strong spectrum from the resulting volatilization. In every case sparks of high electromotive force resembling, as far as possible, lightning discharges, being with my apparatus six feet in length, refuse to strike the surface of a level basin of water, and pass to the edges of the containing vessel. Even if the terminal is brought close to the surface of the water, only a brush discharge manifests itself. In one experiment I inclosed water in the ends of a vacuum tube, Fig. 1. Having exhausted the tube to the point of the vapor tension of water, I endeavored to force a discharge from the surface of the water, *A*, to that of *B*. This was found to be impossible.

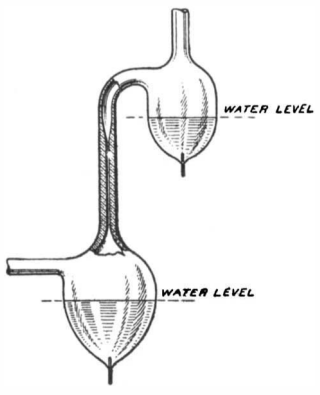


Fig. 1.—VACUUM TUBE CONTAINING WATER.

I was led to these experiments with the desire to obtain a spectrum of water vapor which would be free from all suspicion of the metallic lines of the terminals employed. Subsequent experiments, however, convinced me that with long sparks no metallic lines showed themselves at a distance of even two inches from the terminals. If the quantity of the discharge is made very large by the use of a powerful induction coil actuated by a Wehnelt or liquid interrupter, the metallic lines can be seen further than two inches from the metallic terminals.

It is also extremely difficult to pass powerful sparks from one stream of water to another. In this case we also have two liquid terminals free from any suspicion of contamination of metallic spectra. My apparatus was arranged as shown in Fig. 2. A step-up transformer, giving powerful discharges with a difference of potential of one or two hundred thousand volts, was connected to two vessels of water which delivered two streams of water. It was interesting to see the two streams approach each other under the effect of the alternating plus and minus charges. When the streams were attracted sufficiently near each other, a spark passed which, on account of the high resistance of the water, did not give sufficient light for spectrum analysis. When salt was dissolved in the water, a brilliant spectrum of sodium vapor was obtained. The experiment affords a good class illustration of the attraction of alternating currents, but did not serve my purpose in studying water vapor. It does not seem probable that lightning discharges pass through regions in the air of heavy rainfall.

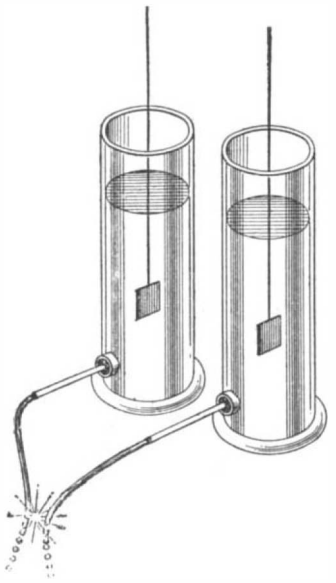


Fig. 2.—EXPERIMENT WITH STREAMS OF WATER.

Lightning discharges which seem to strike the sea really pass from one region of the air to another, and it is only perspective which leads one to suppose that the discharges strike the water. It is remarkable that

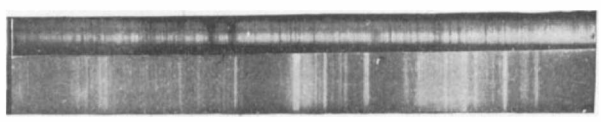


Fig. 3.—SPECTRUM OF WATER VAPOR.

sufficient electric density can accumulate in the clouds to allow a discharge from one region to another. I have reason to believe from my experiences with powerful discharges that we underrate the quantity and voltage of lightning.

Benjamin Franklin would never have tried his famous experiment if he had previously used an apparatus similar to mine.

Having failed to obtain the water-vapor spectrum with the use of water terminals, I turned my attention to the production of the electric spark under water. Certainly in this case I should have the light of aqueous vapor in excess of the light of the metallic terminals. I found it was difficult to produce a spark under distilled water by the simple immersion of the terminals. It was necessary to seal platinum wires in glass tubes, and these wires should not emerge from the glass tubes to a greater distance than half an inch, and moreover should be immersed but a short distance below the surface of the water, if the water is contained in a glass tube of not more than two inches in diameter. If they are immersed to a depth of even two inches, the sparks I employ will instantly shatter the glass tube. The light of the electric spark under water is extremely brilliant, and resembles that of an inclosed arc lamp. There are no lines, however, in its spectrum. The spectrum, in other words, is continuous and like that of an incandescent solid. How shall we picture to ourselves the formation of this light? Is it due to the combustion of oxygen and hydrogen which are set free from the water, or is it possible that the particles of water vapor sufficiently removed from a state of continuity can become incandescent? The spectrum of powerful electric sparks in the atmosphere also shows a continuous spectrum underlying the bright lines which are due to oxygen, hydrogen and nitrogen. It is probable that this continuous spectrum is due to water vapor. The various spectra of lightning obtained by different observers are due to different amounts of water vapor in the air.

Here is the water-vapor spectrum combined with air lines (Fig. 3), the study of which led me to these experiments with electric sparks above and below the surface of water. It consists of a continuous spectrum with marked bands and collection of fine lines, which are collected together especially in the blue and violet parts of the spectrum, which is represented in the accompanying photograph.

I have said that it was necessary to be careful with the employment of powerful sparks beneath water or oil in glass tubes smaller than two inches in diameter. The glass is immediately shattered by an explosion which is not due to heated air suddenly expanding. I am inclined to attribute the explosion to the combination of hydrogen with bubbles of air or oxygen. The dielectric is filled with a fine cloud of gaseous particles. When the surface of the water is covered by a thin film of oil, the water immediately, under the effect of the electric discharge, becomes opalescent and remains so for weeks. Thus we have an interesting case of troubled solutions. It seems to be an electric emulsion formed by the liberation of extremely minute particles of gas or air, which become coated by oil, and we thus have a medium filled with millions of minute soap bubbles.

In Fig. 3 the broader spectrum is that of water vapor and air lines in the blue and violet. The narrower spectrum is that of the corresponding regions in the sun's spectrum. The photograph was taken with a Rowland concave grating and is therefore normal.

The explosion is analogous to that of a dust explosion, with minute bubbles of gas instead of minute particles of carbonaceous matter submitted to quick combustion. It may be that the report of lightning, apart of course from the rolling of the thunder, is due to the explosion of the dissociated gas particles. When lightning exhibits a zigzag path, it occurs in low regions of the atmosphere, certainly below a thousand feet. Its spectrum will therefore show the ordinary atmospheric lines with a continuous spectrum underlying, which is intensified where the hydrogen and aqueous lines occur, as is seen in the accompanying photograph. The hydrogen lines are very broad. When the discharge is above a thousand feet it loses its zigzag character, and with the same voltage as in lower altitudes can be of great length. At still higher regions we have the aurora. Water vapor plays a controlling part in all these phases of lightning.

A New Process of Preserving Butter.

The researches of Fehling have established the fact that gum-arabic and its concentrated solutions are not fermentable. Emile de Meulemeester, of Brussels, Belgium, has found by numerous experiments that, by mixing powdered gum-arabic with butter in the requisite proportions for absorbing the water, the butter can be kept for a long period without becoming rancid. If a small quantity of salt be added the butter will preserve its aroma. This method of procedure is objectionable because it requires too large a proportion of gum-arabic and because the gum should be free from impurities. It is difficult to procure pure gum in large quantities, and its price would speedily become prohibitive if the consumption were large. In order to obviate these disadvantages M. de Meulemeester proceeds in the following manner: Raw gum-arabic is dissolved in water and the solution filtered to remove the impurities. The filtered solution is then mixed with the butter and the excess of liquid contained in the mixture is finally extracted.

RECONSTRUCTION OF THE UNION PACIFIC RAILROAD.

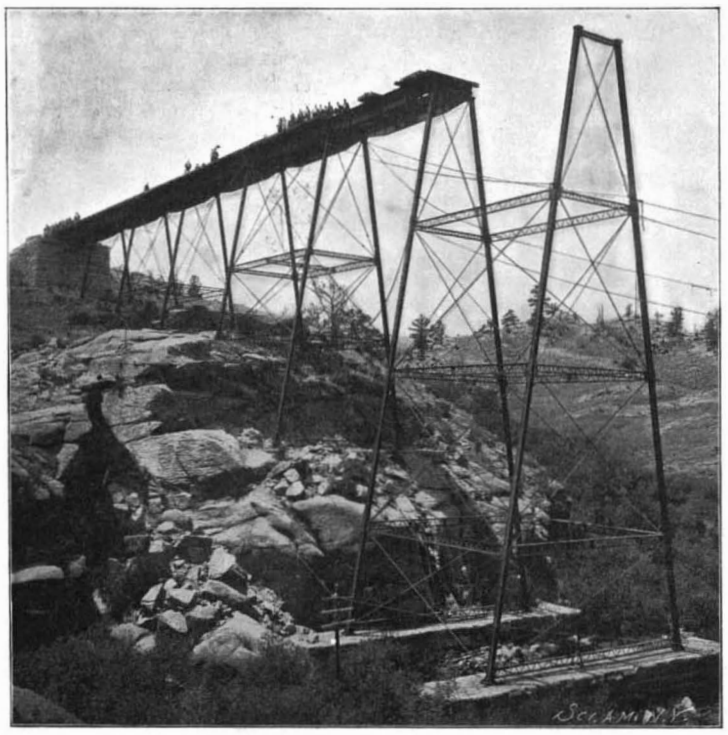
The Union Pacific Railroad was the first transcontinental line to connect the Eastern States with the Pacific coast, and, as in the case of many of its successors, its line was located with a strict view to economy of first cost, and with little, if any, regard to economy of operation; consequently there are in this and in other pioneer roads so much sharp curvature and such steep grades that a severe limit is put upon the number of cars that can be hauled by a single locomotive. Of late years, as the traffic over these early roads has increased, the work of relocating the line, with a view to straightening out the curvature and easing the grades, has been pushed with more or less activity. Probably the greatest work of this kind is that which is now being completed on a stretch of the Union Pacific Railroad between Cheyenne and Evanston in Wyoming. The execution of this costly reconstruction is due to the energy of H. G. Burt, the president of the road, and it is being carried on under the direction of J. B. Perry, the chief engineer.

The greatest hindrance to transportation on the old line was the steep grade over Sherman Hill, which had a maximum ascent of 97.7 feet to the mile. To get around this obstacle, the line between Beaufort and Loraine, a distance of 30 miles, was relocated, and the new survey showed that the summit could be crossed at an elevation 250 feet lower than the old line, and that the desired maximum grade of 43.3 feet per mile could be obtained by cutting a tunnel about 1,800 feet in length. Including this reconstruction, there are about eight different sections of the line between Cheyenne and Ogden on which the old line has been abandoned and an entirely new line built. In a distance of 512 miles, measured on the old line, 158 miles of new road have been constructed with a saving of 30.47 miles in distance. In addition to this reduction there has been established a standard maximum grade of 43.3 feet to the mile over a stretch of the road where formerly grades as high as 68 to 97.7 feet per mile existed. Moreover, the maximum curvature has been reduced from 6 deg. to 5 deg., 4 deg., 3 deg., and on one or two locations as low as 1 deg. The result of this work will be a saving in the amount of fuel used, and a considerable increase in the loads that can be hauled. Thus, the old grade of Sherman Hill necessitated the assistance of fifteen extra locomotives to carry trains over the grade, whereas since the change no extras whatever are required. The total cost of the work has been put down at $15,000,000, and it is estimated that the reduction in actual operating expenses and the increase in earnings will enable the road to recover the outlay within a reasonable time.

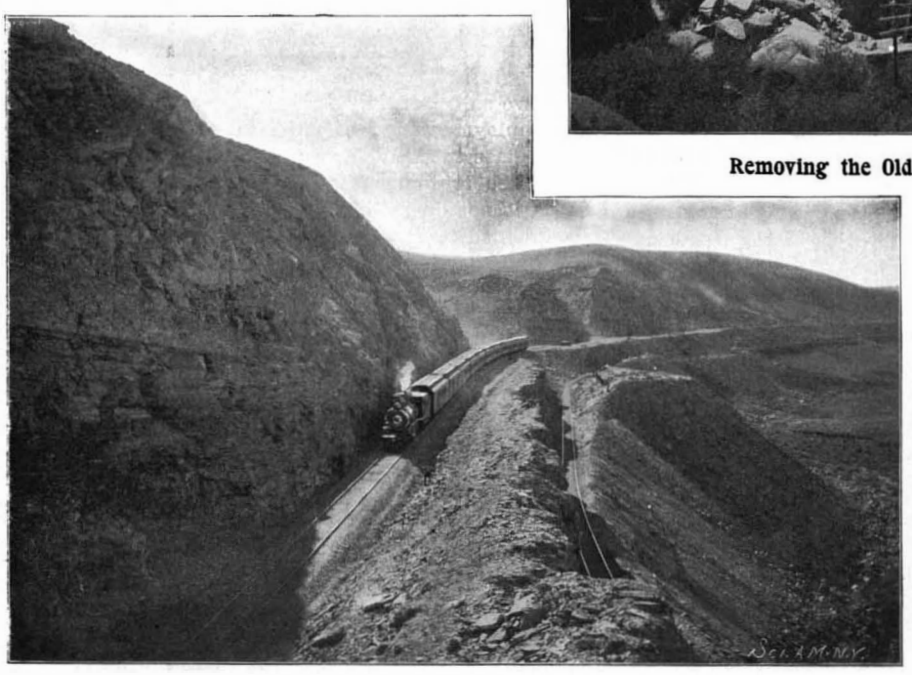
The first improvement lies west of Cheyenne, in the Beaufort-Laramie cutoff. The distance by the new line is 0.37 of a mile greater; but the object aimed at was the reduction of the grade, which has been brought down from 97.7 feet per mile to the ruling grade of 43.3 feet per mile. In this division are three very high fills, the largest of which is Lone Tree Creek, which is 130 feet high, 300 feet in length and contains 350,000 cubic yards of material. The Dale Creek fill, as shown in the accompanying illustrations, is 120 feet high, and contains 500,000 cubic yards. The tunnel at the summit is excavated for 1,800 feet through solid granite. Change of location caused the abandonment of the well-known Dale Creek trestle bridge, 130 feet high and 650 feet long, which is shown in one of our illustrations in process of removal. A point of interest to those who have traveled over the Union Pacific line is that the new line will carry passengers across the summit, at a considerable distance from the great pyramid of cut stone, costing $80,000, which was erected at the old summit to the memory of Oakes Ames and his brother, through whose labors the Union Pacific Road was completed in a remarkably short time.

The next cutoff, from Howell to Huttons, results in a saving of 3.11 miles of distance, with only a single one-degree curve in the whole 15 miles. The location from Cooper's Lake to Lookout saves 0.38 mile in distance; the grade is reduced from 52.8 feet per mile to 43.3 feet, and the maximum curvature from 5 deg. to 1½ deg. At the next cutoff 12.03 miles of distance is saved, and the grade is reduced from 53.9 to 43.3. On the next, from Allen Junction to Dana, 3.87 miles is saved, and the maximum grade is reduced from 75.3 feet to 43.3 feet. At the summit there is a cut 65 feet deep and 1¼ miles long, while there is another on this stretch 80 feet deep and 1,000 feet long. Three cutoffs between Howell and Dana necessitated the handling of 5,400,000 cubic yards of material. The next stretch of relocation saved 1.44 miles and involved the building of 42.83 miles of new track, the maximum grade being reduced from 70.22 feet per mile to the standard maximum. About half a mile is saved on the next cutoff, which is 10.64 miles in length, the maximum grade being reduced from 66.67 to the standard. On the new line, three miles west of the Green River, which follows the cliffs of the Union Bluffs of the Green River, is what is known as the "Fish Cut." The new line, as shown in the accompanying illustration, was cut out of the side of the bluff, and here was involved the heaviest rock work in open cut on the whole line. The next cutoff is 21.6 miles in length, and it saves 9.56 miles in distance, the grades being reduced from 68.6 feet per mile. On this cutoff is the Aspen tunnel, 5,900 feet in length.

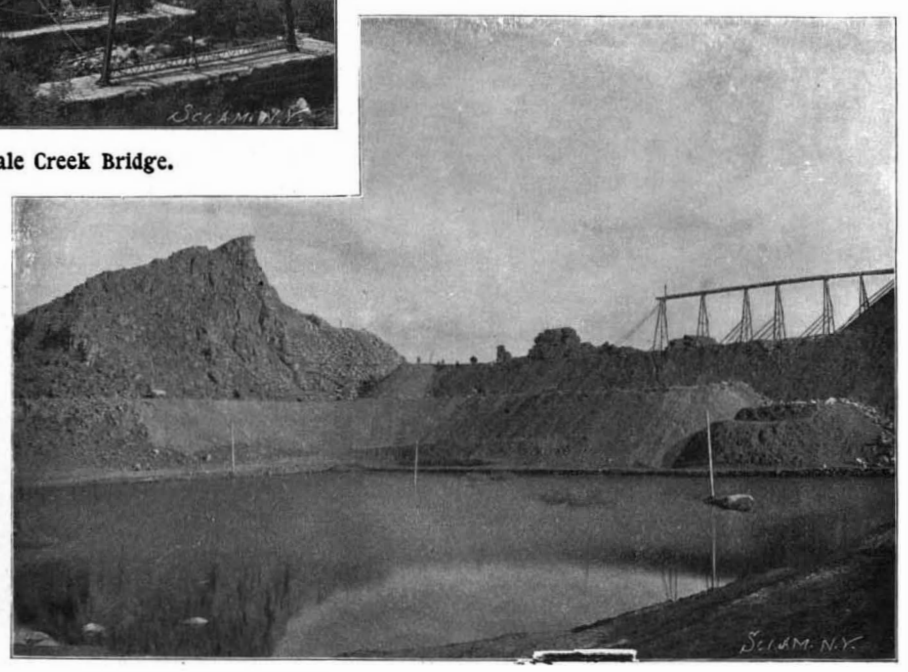
The new track will be laid throughout with 80-pound steel rails: Tie-plates have been used on all curves of 3 deg. and over, while the entire road from Cheyenne to Green River has been ballasted with disintegrated granite ballast.



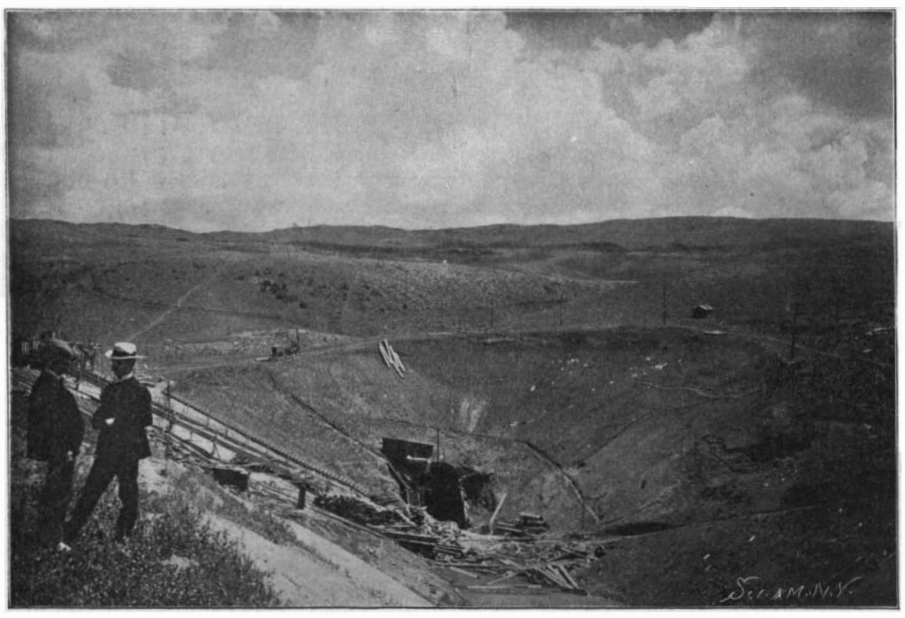
Removing the Old Dale Creek Bridge.



Fish Cut, Green River—Bryan Cutoff; Showing the Old and New Lines.



Constructing One of the Great Fills.



Photographs by J. E. Stimson.

West Entrance to the Aspen Tunnel.

Dale Creek Fill; Buford-Laramie Cutoff. Height of Fill, 120 Feet; Amount of Material, 500,000 Cubic Yards.

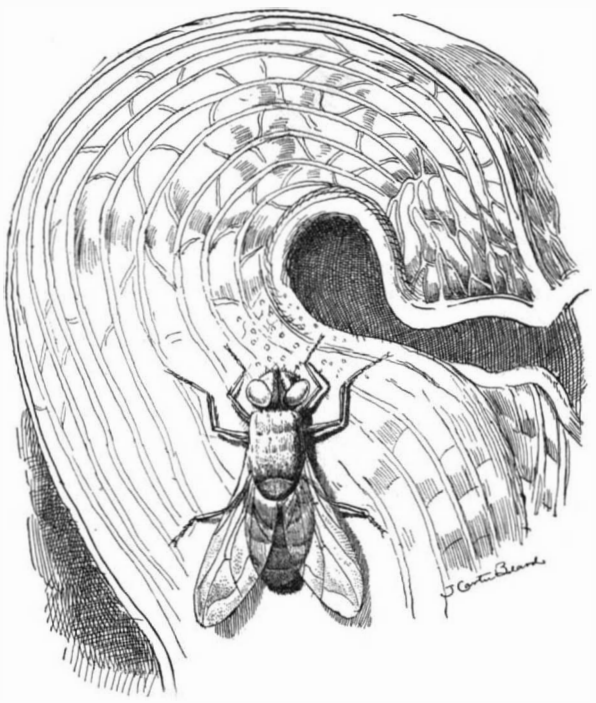
THE RELOCATION OF THE UNION PACIFIC RAILROAD.

WHERE INSTINCT FAILS.

BY J. CARTER BEARD.

Let the reader, as he finds occasion and opportunity, try the following experiment:

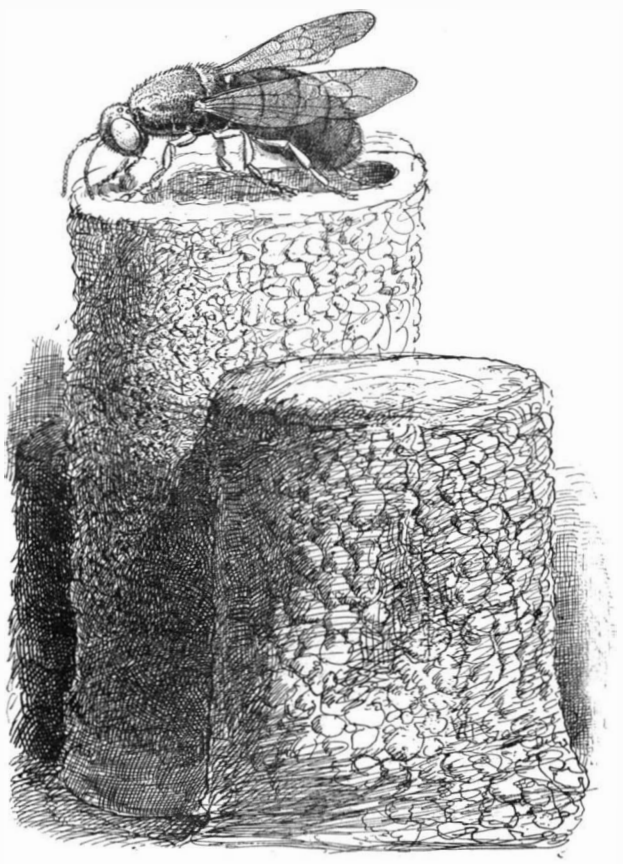
Take a deep, wide-mouthed jar, say from seventeen to twenty inches long, with a neck from five to seven inches in diameter. In this imprison a bee and two or three flies. Place the bottom of the jar squarely



FLY (FEEDING UPON THE HONEY-DEW FURNISHED BY THE SARRACENIA) ABOUT TO ENTER THE PLANT UNDER THE HOOD.

against a pane in the window, drop the curtains about the jar, and unstop its mouth. The flies will invariably make the most of the opportunity given them to escape; the bee, on the contrary, though popularly supposed to be the wisest of insects, will buzz inanely about the closed end through which the light comes, without seeking to escape in any other direction. Light and liberty with the bee are synonyms, and she will perish rather than prove false to her convictions. You can keep her confined with the back door of her prison house wide open as long as you choose; she will not find her way out. Open the window, reverse the jar, and she is off rejoicing about her business, for she is a business female in the strictest sense of the word, a person of regular habits, wedded to a life of routine, within the bounds of which her abilities are indeed wonderful.

Mr. Fly, on the contrary, an idle fellow, "a man about town," whose irregular habits subject him to innumerable perils, has developed a faculty for getting out of scrapes which, though perhaps not equal to that he possesses for getting into them, is superior to anything of the sort his more industrious compeer can boast of.



A BEE (CHALICODOMA) ERECTING A SKYSCRAPER UPON A CELL ALREADY BUILT.

Near the cottage where an experiment similar to the one here described was, in pursuance of the suggestion of Sir John Lubbock, tried, grew some pitcher plants; and toward these, as if to show that the instinct of flies also has its limitations, the prisoner that first escaped from the jar made his way. These pitcher plants are the tippling places of fast insects of various sorts, particularly flies. Spread about the opening to the vegetable saloons is a regular free-lunch counter open to all comers. Mr. Fly, attracted by the drops of nectar upon the curious leaf of the Sarracenia, unsuspectingly follows the trail of treacherous sweetness to the portals of the vegetable saloon where the nectar is abundant.

He is a thirsty individual; perhaps his free lunch makes him more so; and the cool, green depths of the pitcher-plant contain a store of tempting liquid refreshment. He crosses the hospitable threshold and enters what is to him a spacious and elegant apartment, strolling along, stopping here and there to sip a drop of nectar, until he is well within the walls of the enfolded leaf. Here he encounters a glazed zone; a portion of the leaf of such a peculiarly smooth and slippery surface, consisting of delicate, overlapping glossy hairs, upon which even he, that can walk upside down upon a glass skylight, finds it difficult to keep his footing. He slips and falls, but spreading his wings, flies and attempts to alight on the opposite side, a little further down perhaps, to avoid the slippery zone, but encounters a surface thickly set with stiff, downward-pointing hairs, that affords him no footing; and even if he succeeds with the greatest difficulty in alighting, prevents his progress upward. Taking flight again and pounding against the walls, bewildered, tired, perhaps stupefied or intoxicated by the food he has taken, he inevitably, sooner or later falls into the liquid at the bottom of the tubular leaf, a pool of death in which are already imprisoned the bodies of numerous previous victims, and so incontinently becomes a subject "to point a temperance lecture or adorn a tale."

Nor is this the only way in which the instincts of flies mislead them. There are certain fungous growths belonging to the Phallus family, which give out a fetid odor very attractive to flies, which lay their eggs upon them, as they would upon decaying animal substances, with the result that the larvæ when hatched perish for lack of food; this is also the case with the odors of several other plants. A smell of cooking cabbage, for instance, has an attractive effect upon bluebottle flies, which if not shut out gather in swarms about the place where that delectable vegetable is being prepared for the table. Sir Stamford Raffles, the discoverer of the *Rafflesia Arnoldi*, a large, fleshy parasite growing out of the roots of other plants, writes:

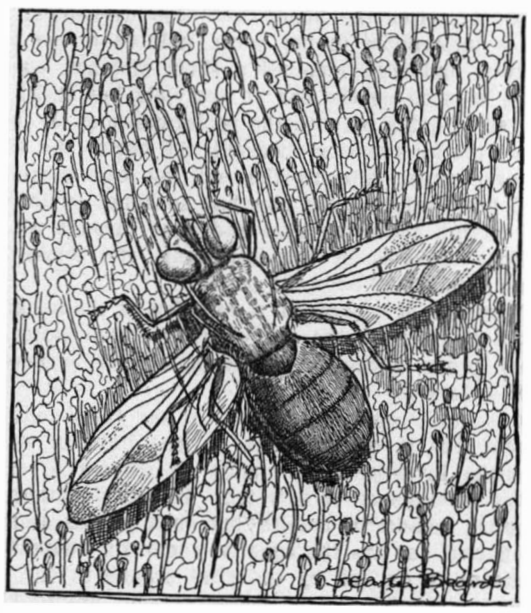
"When I first saw it, a swarm of flies were hovering over the mouth of the nectary and laying their eggs in the substance of it. It had exactly the smell of tainted beef."

Some very interesting and amusing experiments have been made in endeavoring to determine the nature of the instinctive faculty that impels the mason bees to build their curious structures. Mason bees fashion nests of very solid masonry. *Chalicodoma muraria* is solitary in her habits; she constructs her habitation alone and unaided, usually selecting a bowlder of considerable size as a solid basis upon which to build an adobe edifice of a suitable sort of earth moistened with her own saliva. When this is about an inch high she proceeds to fill it about half full of honey and of pollen; lays an egg on it, and closes it over with a roof of cement. After eight or nine of these cells have been completed she adds an additional protection, a thick layer of mortar placed over the entire construction.

A cell in an early stage of construction was taken away, and in place of it was substituted one already built and stored with honey and pollen. One would, in such a case, naturally suppose that the mason bee, glad to be saved so much labor, would simply supply the necessary egg and seal up the cell. But no, indeed! the regular, ancient and established custom in the *Chalicodoma* order of procedure is far too important to be disturbed by a little thing like this; the bee calmly goes on building until the cell is built up as much as a third more than the proper height; then, although a sufficiency of provision for the larvæ had been already supplied, she wastes labor in adding thereunto a second and a supererogative store of food.

Another experiment consisted of piercing a hole in the cell below the part where the bee had been working. In this case the bee is of the same genus, but of a different species from that just described; it is the *Chalicodoma pyrenaica*. This species builds cells as does the other, but fills them with honey as she goes on, raising the walls a bit, then going on several expeditions for honey, then building up the walls again, and so on until the cell is finished.

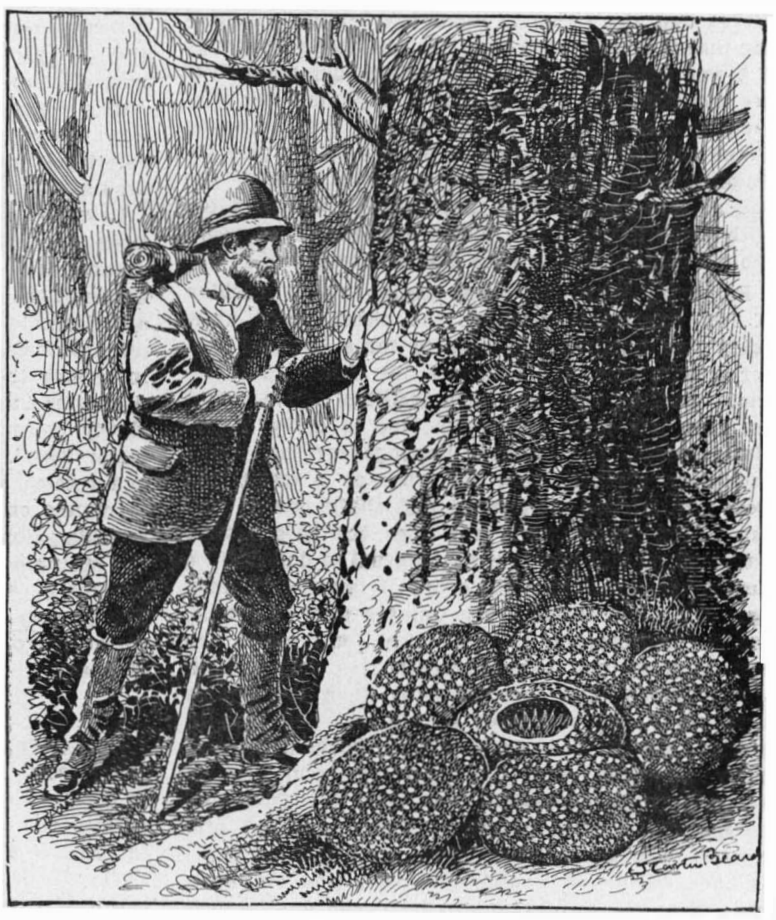
A cell was chosen which was almost completed, and while the bee was away a hole was pierced in the cell below where the bee was working, allowing the honey in the cell to gradually escape. Entirely ignoring an incident so contrary to precedent and established usage, the bee on her return calmly worked



SMALL FLY ENTRAPPED BY THE BRISTLES OF SARRACENIA.

away as if nothing had happened, adding mortar to the edges of the cell and honey, which immediately ran out, leaving the nest empty. This experiment was repeated many times with differences of details, but none in the results. As it might possibly be conjectured that the bee had failed to notice the injury a cell was selected which had but a very little honey in it. A large hole was made in this, which the bee returning with the honey certainly noticed, for she went down to the bottom of her cell, and not only examined the aperture carefully, but felt its edges with her antennæ and pushed them through it. Did she then, as might naturally be supposed, stop it up? Not at all. To do so would be to prove false to all the traditions of her race—be a departure from the immemorial usages of the Chalicodomians, and introduce a new and a disturbing element into the ancient and honorable order of mason bees.

However this is, the poor, devoted creature went on emptying into this vessel load after load of honey, which, as a matter of course, escaped at the bottom as fast as she emptied it at the top. All of one long, hot summer afternoon did she labor at this bootless task, and began again next morning. At last, when, regardless of the result, she had performed her prescribed duty in the prescribed manner, made the cus-



THE PLANT RAFFLESIA ARNOLDI, GIVING OUT THE SMELL OF TAINTED BEEF, UPON WHICH FLIES LAY THEIR EGGS.

tomary amount of journeys and supplied the usual amount of honey, she conscientiously laid her egg and closed up the empty cell.

A detail of her work shows its absolutely automatic character. When the bee brings provisions to add to the stock it has already collected she carries both honey and pollen; in order to deliver these she begins by going head first into the cell and disgorging the honey; then, coming out, she turns around and backs into the cell, and brushes and scrapes off with her hind legs the pollen, quantities of which adhere to the hairs that grow upon the under surface of her body. If, after the honey has been discharged, the bee is interrupted in her work, induced to get upon a straw and then removed a short distance, she returns as soon as she can to complete her task; but instead of going on with the performance at the point where the interruption occurred, she begins the series all over again, entering the cell (at least partially) head first, although she now has no honey to deliver; and having spent the time and gone through all the motions required by this ceremony, she comes out, turns around and adds the pollen.

These are, of course, but a very few of the instances where instinct, or the reflex actions often called instinct, prove inadequate to accomplish the purpose of their existence.

It is quite common to speak of the intelligence of insects, but it really seems, in the light of recent scientific investigations, almost as correct to speak of the intelligence of a watch. Insects doubtless accomplish wonderful results, but such results seem to be effected (as are the equally wonderful adaptations of means to an end by the vital organs in our own bodies) by automatic, unconscious, and unintelligent obedience to internal or external stimuli.

Engineering Notes.

From London comes the news that Mr. Drummond, the engineer of the London and Southwestern Railway, has succeeded in applying the water-tube boiler to locomotives of his line. So eminently successful were the trials that it has been decided to use water-tube in place of fire-tube boilers. A Times correspondent states that in a journey from London to Sailsbury a water-tube engine, drawing twelve cars, finished the trip without any difficulty whatever and without any priming. The coal consumption is said to have been less than 29 pounds to the mile.

A writer in Nature points out the advantage that would be gained by the use of magnetic iron ore as a material for concrete blocks. He points out that if magnetite is used instead of ordinary rock in the shape of fragments, and magnetic sand or ilmenite sand instead of common sea sand, concrete blocks can be obtained which have all the strength of the ordinary concrete blocks, and which weigh, when immersed in water, exactly twice as much as the ordinary blocks. Such an increase in weight makes the magnetic blocks far superior as regards resistance to the waves. Work constructed with magnetic blocks will stand when other work will be destroyed.

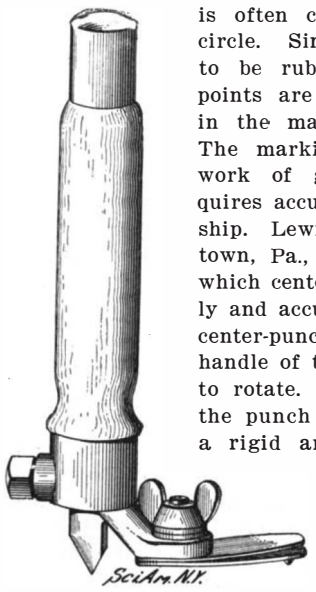
The president of the British Board of Trade has just issued the new rules for the prevention of accidents to railway employés. An English correspondent observes that the action is somewhat belated, considering that it is two years since the Automatic Couplings Act was passed. It seems incredible that more lives are sacrificed each year on the railways than the total casualty list of eight of the biggest battles in the Transvaal. By the new rules the use of the pole for coupling and uncoupling purposes will cease at the end of this year, and all new wagons will be fitted with brake levers, while within a period of ten years the old rolling stock will be similarly improved.

For many years the steam engine was a machine of low rotational velocities, the piston speed averaging two hundred and fifty to three hundred feet per minute only, and this was due chiefly to inadequate machine tools and shop facilities which would not turn out work sufficiently true to allow higher piston speeds. For instance, bearings were not round and plane surfaces were not true; as a result, the wear and friction were great and shafts heated and cut. After better work was done the speeds were increased, so that now it is not unusual to find engines running at three times the speed of twenty-five years ago. One great obstacle then was the wear of details, but the improvement in mechanical construction has been so great that there is actually less wear at high piston speeds than was the case when low speeds were used. One high-speed engine that had been in constant use for 1,560 days, thirteen hours daily, was lately examined, with the following results as to wear: Journals generally, from 0.002 to 0.007; connecting rod brasses in crown, 0.02; crosshead pin, greatest wear in one part, 0.002; eccentrics, no wear. Another engine of a different make was examined after three years' constant use daily, and was in such good condition that it was connected up and started again without any repairs whatever.

Patent Department

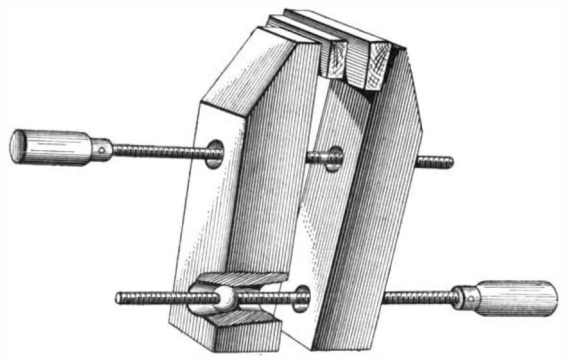
SIMPLE AND INTERESTING INVENTIONS.

Tool for Centering Drills.—In marking the center of a hole to be drilled with a center-punch, the metal is often chalked to describe the circle. Since this circle is likely to be rubbed out, a number of points are pricked with a punch in the material along the circle. The marking of the points is a work of great precision; it requires accuracy and fine workmanship. Lewis Williams of Johnstown, Pa., has invented a tool by which centering can be more rapidly and accurately accomplished. A center-punch forms the axis of the handle of the tool, and is mounted to rotate. A socket is secured to the punch by a setscrew and has a rigid arm to which a bar is pivoted, carrying a center point. The bar and arm are clamped in adjustable relation. It is obvious that the two points can be brought to any distance within the limits of adjustment, and that the centering point can be applied to prick the center. The center-punch can then be swung around on the center-point as a center and tapped with a hammer to make an indentation.



TOOL FOR CENTERING DRILLS.

Clamp.—The ordinary carpenter's clamp has the defect that it cannot be adjusted to any desired angle. Hans Jorgensen, of Chicago, overcomes this defect by using right and left threaded handscrews. The jaws



CARPENTER'S CLAMP.

are bored laterally to receive short pieces of shafting, each of which is bored to receive the right and left threaded handscrews. By means of this construction the jaws can be set at almost any desired angle to each other, thereby obviating the necessity of using additional plugs in connection with the parts to be clamped.

Sword-pistol.—Domenic A. Ricco, of Long Island City, N. Y., has combined a sword and a revolver in such a manner that one handle serves for both. Hence either weapon can be used without changing the grip. First the revolver can be brought into use until all the cartridges have been fired, and then the weapon can be used as a sword or cutlass.

Lawn-sprinkler.—Among recent interesting inventions is a lawn-sprinkler for which a patent has been granted to A. Vandervoort, of Belleville, Canada. The nozzle of the sprinkler is automatically swung through a horizontal orbit and is at the same time slowly moved up and down, through a vertical arc, thereby largely increasing the area of lawn affected by the sprinkler. A flexible tube connects the nozzle to a rotating plug slowly driven, through gear connection, by a water-motor wheel. A thread formed on this plug engages and rotates a worm wheel. The nozzle is connected to cranks on the shaft of this worm wheel, thereby receiving its vertical movement. The speed at which the sprinkler operates is governed by regulating the amount of water used for turning the motor wheel. The base is provided with brace-arms to prevent the sprinkler from tipping under the pressure of the stream of water.

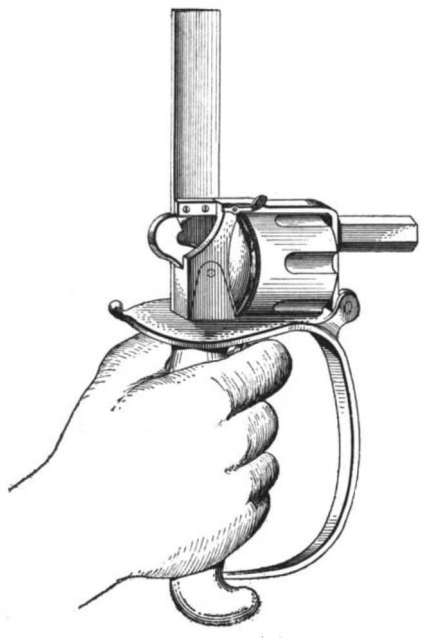
The Inventors' Institute.

Our contemporary The Electrical Age publishes a letter from "An Old Inventor," which calls attention to a matter of sufficient importance to enlist the sympathies and active co-operation of everyone interested in engineering.

The letter very truly states that most inventors are men without means to construct their machines, and suggests that one of the greatest needs of the present day is the establishment of an institution for the assistance of inventors. If a model shop could be established on a self-endowed basis, the writer believes that men of science could easily be prevailed upon to act as governors and pass upon the inventions submitted to them. Just how great the scope of such an institution would be, could be determined only by experience. It goes without saying that, by helping the inventor, science in almost every branch would be rapidly advanced.

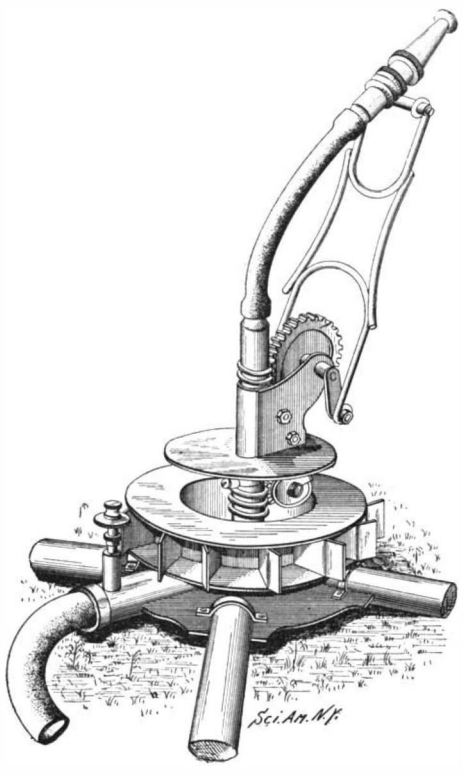
The Qualities an Inventor Must Possess.

There is no pursuit more fascinating than that of an inventor, writes Emil Berliner in the Saturday Evening Post. The inventor is privileged to dip into every calling. If he has the right sort of mind, it is not at all essential that he understand everything connected with the art with which he desires to make himself familiar. He need only take that particular corner wherein the problem that he is after lies, and work it thoroughly. But thorough the work must be. He must



SWORD-PISTOL.

have more than the patience of Job, more than the perseverance of the beaver, more than the industry of the bee. He must work hard, and be content to work for months at a time without making any apparent progress. He must be content to travel over the same field again and again and again, indefatigably. That is the secret of the inventor's success—never-ending application. The idea that an inventor is necessarily a genius is entirely fallacious. Genius for invention is merely the capacity for concentration and for work. Given these qualities, and a power of close observation, and you have the make-up of a successful inventor. He need be no learned scientist, and yet he may be able to work up most valuable inventions in many sciences. He need be no perfectly trained electrician, and yet he may be able to work up a valuable electrical appliance. But always he must be prepared to take advantage of new phenomena, and to know all about

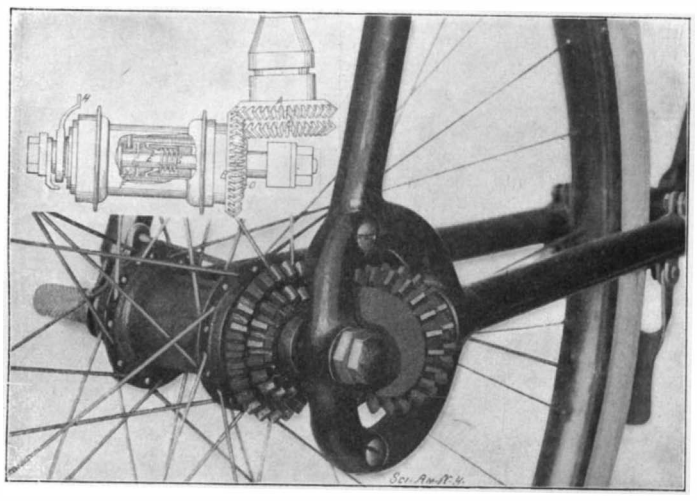


LAWN-SPRINKLER.

the field in which they lie. Many of our most important inventions are the result not so much of deep knowledge as of the power of observation and the ability to appreciate the possibilities of phenomena that the less observing would pass by without seeing.

THE CHAINLESS-BICYCLE COASTER-BRAKE GEAR-CHANGER.

From the very advent of the safety bicycle inventors began to devise speed-changing gears, which, as a general rule, were so fearfully complicated as to be utterly impracticable. Difficult as the problem has been, so far as the chain bicycle is concerned, it must be confessed that it has not become simpler in the modern chainless wheel. The chief requisites of simplicity of construction and certainty of operation have been so wofully lacking in the speed-changing gears devised for both forms of bicycles that bicycle manufacturers have almost given up the hope of ever securing the contrivance they desire. Among the inventions recently patented in the United States is



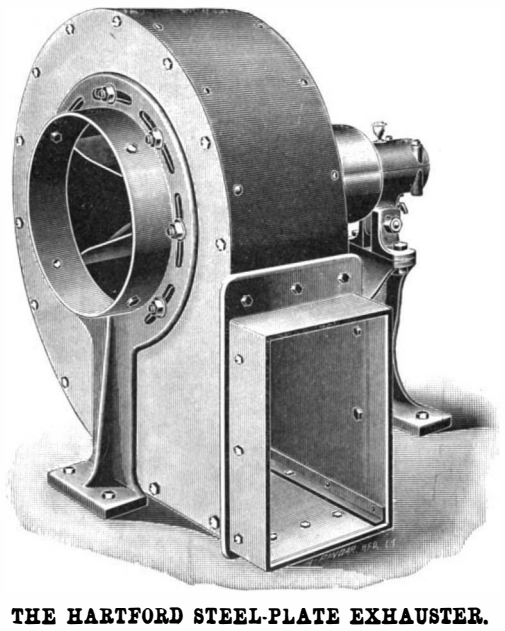
THE MAYNES CHAINLESS SPEED-CHANGING GEAR.

a differential gear for chainless bicycles which seems to possess all requisites to such an eminent degree that it will shortly be adopted by one of the leading bicycle companies. The inventor of the device is Hyla F. Maynes, of Corning, N. Y., formerly of Gaines, Pa. The accompanying illustration is reproduced from a bicycle to which the invention has been practically applied.

Broadly speaking, the changeable gear consists of two gears, *A* and *C*, carried on the drive-shaft passing through one of the hollow, lower braces; independently acting gears, *B* and *D*, respectively meshing with the gears, *A* and *C*, and carried by hubs adapted to rotate within the hub of the rear wheel; and a clutch mechanism of approved form, which is operated by back-pedaling. The gears, *A* and *B*, and *C* and *D*, provide two speeds; when the one set is in operation, the other set is left to rotate. The gears run one within the other and are never disengaged from each other. If the rider wishes to coast the pedals are held still. In order to apply the brake, which is of the well-known A. B. C. type, the pedals are pushed back about 1-16 of a revolution. A backward movement of about 1-32 of a revolution will change the gear from high to low, or from low to high. The brake can also be applied without changing the gear. The clutch mechanism employed locks the gear to be used to the driving axle, and releases the other gear. A clutch, *G*, shown in the diagram serves the purpose of separating the clutch members. In the diagram the letter *H* represents the brake lever of the A. B. C. brake. The wheel from which our photograph was taken has been ridden for two years without serious accident.

THE HARTFORD STEEL-PLATE EXHAUSTER.

The accompanying cut illustrates the Hartford patent adjustable, interchangeable and reversible steel-plate exhauster. The journals are supported by self-oiling bearings, secured to standards which are adapted to be bolted to a floor or to overhead timbers. On the inlet side of the shell is a supporting standard



THE HARTFORD STEEL-PLATE EXHAUSTER.

that has an annular head, and on the pulley side of the shell is a standard that has a disk head. These heads are circular, and near the outer edge of each is a circular series of slots. Bolts extend from the side walls of the shells through the slots of the head, and are provided with washers and nuts. If these nuts are loosened the shell is free to be adjusted about the axis of the blast wheel in either direction; and if the bolts are removed the shell may be completely revolved and set with the discharge outlet pointing either vertically up or down; 30 deg. up or down; 45 deg. up or down; 60 deg. up or down, or horizontally to either side or to any intermediate angle. When the discharge is pointed in the desired direction, so that the discharge pipe may be connected in the most convenient manner without elbows or angles, the bolts are replaced and the nuts tightened to secure the shell in that position; also, when the bolts are removed the shell may be taken from between the standards and replaced in a reversed position—i. e., with the inlet on the opposite side—thus converting a right-hand machine into a left-hand machine, or *vice versa* as may be desired.

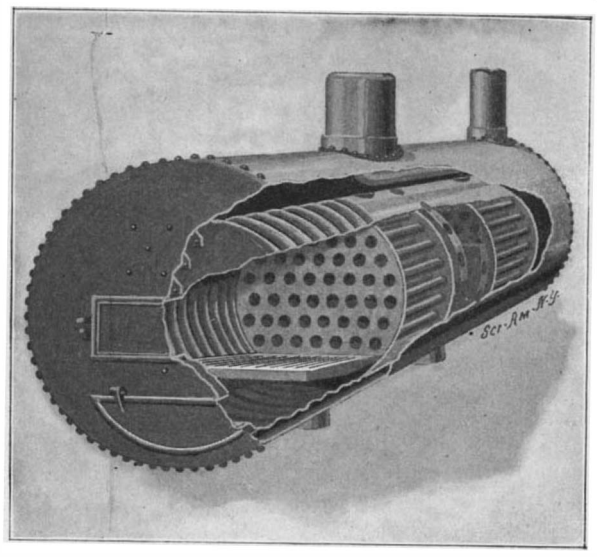
This construction enables the user to place the exhauster either on the floor, or reverse it and bolt direct to overhead timbers, thus saving the cost of building an expensive platform on which to place the exhauster, allowing the machine to be operated to the best advantage without the use of cross belt, etc. After using the machine for a time in one place, if the user desires to make changes in his plant, thus changing the piping system, he may change the exhauster from a right-hand to a left-hand, or *vice versa;* change the discharge so it will point in any desired direction; place the machine on a floor or reverse it and bolt direct to overhead timbers, etc., and not be required to purchase a new machine in order to comply with the conditions of the altered arrangements. The simple construction of this exhauster combines over twenty machines in one, and all the changes and adjustments can be made with the aid of a monkey wrench only.

The shells are built of sheet steel, while the other parts are of gray iron castings with the exception of the shaft, which is of best steel for the purpose. The machine is fitted with reversible bearings of the well-known ring-oiling type, which allow it to be operated with very little attention; all that is necessary is to keep the oil reservoirs supplied with oil. It is made with very heavy blast wheels in order to withstand the wear and tear of shavings, chips, blocks, etc., which pass through the machine. It is especially adapted for handling shavings, sawdust, chips, etc., from woodworking machinery; dust, lint, etc., from polishing and buffing wheels; for conveying wool, cotton, and all kinds of like material; for removing steam, gas, smoke and odors; for heating and ventilating purposes, and for mechanical forced and induced draft apparatus. The manufacturers are the Hartford Blower Company, 70 Suffield Street, Hartford, Conn.

THE REGAN LOCOMOTIVE BOILER.

A locomotive boiler, which is arranged to provide a large heating surface and to insure complete combustion of the fuel, has been recently invented by Mr. John J. Regan, of 166 Third Street, Jersey City, N. J. It consists essentially of two shells, one being arranged eccentrically within the other. There is thus formed between the shells a steam and water compartment leading to a steam dome, from which extends the usual supply-pipe carrying generated steam to the engine. The near end of the internal shell, as shown in the illustration, forms a fire-box, from which a set of smoke-flues extend, through a water-compartment, to an auxiliary combustion chamber containing water-jacketed deflectors. Thence a second set of smoke-flues extend through a second water-compartment to the smoke-box. Under the grate in the firebox is an air inlet which is provided with a valve under the control of the engineer. A similar inlet is located in the auxiliary combustion chamber. The smoke and gases, passing through the first set of flues, enter the auxiliary combustion chamber, and after passing downward under the first deflector and upward over the second, continue through the next set of flues to the firebox.

It is evident that this arrangement provides a large heating surface resulting in greater economy in the consumption of the fuel. There is a complete circulation of water, which is an important factor in keeping all surfaces at a uniform temperature. The combination of two sets of flues with an auxiliary combustion chamber results in utilizing more of the heat in the gases, and this, together with the arrangement of the deflectors, insures the consumption of a large proportion of the sparks now thrown out of the stack. When it is found necessary, air can be admitted to the fire-box and the auxiliary combustion-chamber to insure complete combustion. There are no flat places or corners in the boiler where mud can collect and cause overheating of the seams. All flanges look outward, thus greatly facilitating the calking and inspection

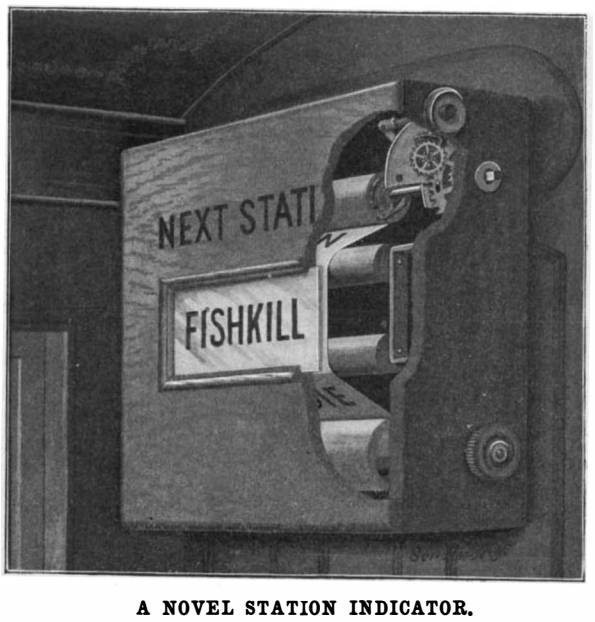


THE REGAN LOCOMOTIVE BOILER.

of the seams, and the flues being shorter than in present boilers, will necessarily have a longer life.

STATION INDICATOR.

Our illustration shows a simple and durable apparatus which is designed for use in railroad cars and street cars to display the name of the next station or street prominently. It is the invention of A. M. Taylor, of Port Ewen, N. Y. The apparatus is contained in a neat casing which may be secured to the side of the car. Within the casing and mounted on a roller at the bottom, is a web of paper on which the station or street names are printed. The web passes up over two idlers at the center of the indicator, and thence to a take-up roller at the top. The portion of the web between the two idlers is displayed through a window in the front of the casing. The take-up roller is loosely mounted on a shaft, to which is fastened a ratchet wheel adapted to engage a spring-pressed pawl fulcrumed on the end of the take-up roller, so that the latter moves with the shaft when the paper is being wound up, but is independent when the motor-spring is being wound up, or when the paper is being wound back and reset. A gear wheel is loosely mounted on one end of the shaft and is connected to it by means of a pawl and ratchet, whereby the gear is caused to turn in the direction in which the paper is wound, but is stationary when the shaft is turned in the opposite direction to wind up the motor-spring. The spring is secured to and coiled about the shaft, its outer end being attached to the casing. Near the periphery of the gear-wheel is a slot adapted to receive a pin which keeps the wheel from turning. By pressing the button near the top of the indicator,



A NOVEL STATION INDICATOR.

this locking pin can be withdrawn, thus permitting the wheel to rotate until it has made one complete revolution, when the pin, under tension of a spring, snaps again into the slot and locks the mechanism. A suitable escapement is connected with the gear-wheel to govern its motion.

In operating this indicator the attendant of the car needs merely to press the button and the mechanism will automatically wind up, the web stopping when the roller has made one complete revolution, which will bring the next station or street name into view. The web is long enough to have the return stations indicated on the unrolled half. A thumbnut is attached to the shaft of the lower roller, by the turning of which the web can be wound back and reset. The motor-spring may be wound up by a key or crank applied to the squared end of the take-up-roller shaft.

Brief Notes on Patents.

Some time ago we called the attention of our readers to the fact that the Examiner of Interferences of the United States Patent Office had awarded priority of invention to Linde in the Liquid Air Interference, Tripler vs. Linde. News now comes from Washington that the Board of Examiners-in-Chief has affirmed the decision of the Primary Examiner.

A New Haven photographer, A. Hyatt Verrill, a son of Prof. Addison E. Verrill, of Yale University, announces further discoveries in his experiments with color photography. Verrill says he has found it possible to produce "aurotypes" and "argentypes" simply by depositing gold and silver in metallic form on glass, wood. metals and even on paper. The pictures thus made are claimed to be absolutely permanent.

A company is being formed in St. Louis for the manufacture of the power plow designed by Richard J. Gatling, the designer of the famous rapid-fire gun bearing that name. This machine is said to do the work of from thirty to forty men, using from sixty to eighty horses, and the cost per day for fuel is said to be six dollars when using oil, wood or coal and two dollars per day when using gasoline. A wheat drill may be attached to the machine, and the grain sown as the disks turn up the earth. The first public appearance of the Gatling plow will be at the St. Louis exposition.

Jerome Wheelock, the builder of the Wheelock engine and an inventor of national repute, dropped dead on the street on February 25 in Worcester, Mass., where he resided. Mr. Wheelock began life as a machinist and soon developed into an inventor, his first important work being a piston packing. The engine designed and built by him had many novel features, and it was a feature of the Centennial Exhibition, where it was shown for the first time. Nearly all of his patents related to the steam engine. Mr. Wheelock was a member of the American Society of Mechanical Engineers.

The ninety-fourth anniversary of the first successful burning of anthracite coal in a grate was celebrated at the old Fell Hotel in Wilkesbarre, where that interesting event took place. The old fireplace and grate are still preserved, and the room in which they are located was gayly decorated in honor of the event. A banquet was served, and among the speakers was H. P. Fell, a descendant of Jesse Fell, the old proprietor of the house. The first steps were taken toward the celebration of the centennial anniversary of the discovery six years hence, and it will in all probability be an affair of national and State importance.

An explosion took place in the nitro-glycerine house of the Cerberite Manufacturing Works at Ardwick, Md., on the morning of February 5, and although the concussion was terrific, a large quantity of the cerberite, which was stored in another house only a short distance away, was not affected, thus giving a practical demonstration of the remarkable quality of the explosive, which, it is said, requires the combined action of flame, heat and concussion to detonate. In practice, a percussion cap is used to explode it. Cerberite is the discovery of Count Sergy de Smolianoff, a Russian chemist who died about a year ago in Washington, D. C.

The removal of electric incandescent lamps is such a common form of nuisance that there seems to be some demand for the locking lamp socket which has been recently patented by Charles R. Barrett and Elwood C. Phillips, of Chicago, Ill. There is a closed chamber located laterally at one side of the lamp socket, inside of which is a locking detent supplied with the usual spring. In the walls of the chamber is a keyhole for the insertion of the key with which to throw back the locking mechanism. It is the custom in many places to turn the lamp out of or into service by giving a twist to the bulb, and this locking arrangement does not in the least interfere with this. The locking detent engages with a recess in the threaded foot of the lamp, and this permits of a certain amount of freedom in the turning of the lamp in its place.

Dr. M. G. Burgess, of Herkimer, N. Y., besides being a very busy physician is an inventor and an excellent mechanic. He has recently secured patents on an operating table which is said to have many advantages over the old type. After designing a table to meet the demands of the operating surgeon, the doctor, with no other assistance than that of an unskilled man, set about and built a table which would be considered a very flattering job turned out from a well-equipped industrial plant. The table works on the hydraulic principle, and the motions of raising, lowering and tilting are all controlled by a single lever, which is a great convenience, these motions all requiring a separate lever in all the types now in use. The system of drainage marks an improvement also, as all fluids are caught at once and disposed of, no matter what the position of the table is. Although there is great freedom permitted in the movement of the table, the mechanism is very simple and devoid of cogs, gears and ratchets.

Legal Notes.

Houghton, Mifflin & Co. have brought two cases up before the Court of Appeals which involve alleged copyright infringement of two of their publications. The first of these appeals, in which Dutton & Co. are the respondents, originated in a bill to protect a copyright in a portion of "The Minister's Wooing;" the second is based upon an alleged copyright infringement of a portion of "The Professor at the Breakfast Table." The copyrights were taken out under the Act of February 3, 1831. Both parties claim the benefit of a renewal.

Twenty-nine of the forty-two chapters of "The Minister's Wooing" were serially published in the Atlantic Monthly from December, 1858, to October, 1859. In October, 1859, Mrs. Stowe took out a copyright of "The Minister's Wooing," as a whole, and in the book published by her authority a proper notice of this copyright was entered. After taking out this copyright the remaining thirteen chapters were published in the Atlantic Monthly for the same year, and the numbers in which they appeared bore on the title pages "Entered according to Act of Congress in the year 1859, by Ticknor & Fields, in the Clerk's Office of the District Court of the District of Massachusetts." The Circuit Court found that the publication of the first twenty-nine chapters without any copyright abandoned them to the public, and that as the remaining chapters were published with no notice of the copyright, except that which we have stated, sufficient notice was not given of a copyright by Mrs. Stowe. The Circuit Court of Appeals affirms this decision of the lower court.

So far as "The Professor at the Breakfast Table" is concerned, ten of the twelve parts of which it is composed were published serially in the Atlantic Monthly between January and October, 1859, without any notice of copyright. The remaining two parts were published in the following December, upon which a copyright was obtained, and a notice thereof given in the magazine in the manner adopted in the case of "The Minister's Wooing." When the entire work was published in one volume Dr. Holmes copyrighted it. The Circuit Court of Appeals held in accordance with the lower court that a literary work published serially with the consent of the author, and copyrighted in the name of the publishers, gives rise to such conditions that the author cannot subsequently secure the copyright. If the author subsequently republishes the work in book form, with a copyright notice in his own name, such republication with such notice effects, under the statute, an abandonment of the copyright.

The Stanley Steam Carriage in Court.—The Whitney Motor Wagon Company has brought suit against the Stanley Brothers, Newton, Mass., for infringement of its patents. It is claimed that the Whitney patents antedate the patents of Francis E. and Freeland O. Stanley. The Whitney patent, No. 652,941, contains 46 claims, and is said to cover the foundation principle of the steam vehicle. It is asserted that the Stanley vehicle is a direct infringement of the original Whitney wagon, which was built in September, 1897. In that year Mr. Whitney, it is claimed, not only turned out the first steam carriage made in this country, but also built an improved carriage. The Stanleys are the inventors of the steam carriages sold under the names of "Locomobile" and "Mobile," the rights to manufacture which were acquired by Amzi L. Barber and J. Brisben Walker, the former president of the "Locomobile" Company of America, and the latter president of the "Mobile" Company of America and editor of the Cosmopolitan Magazine. Since selling this invention the Stanley Brothers have produced a new vehicle, which differs somewhat from the original, but which is declared to possess the fundamental principles of the first vehicle. It is claimed that this machine is an infringement of the Whitney carriage; that the Stanley Brothers had had ample opportunity to inspect the wagon, which was at the Mechanics' Building, Boston; that the Stanley vehicle was not produced until after Whitney's had been inspected, and that the Stanley carriage is a close copy of the Whitney vehicle. The outcome of the suit will be awaited with interest.

The case of Metz vs. Johnson, decided in the Circuit Court for the District of Massachusetts, shows that an inventor cannot be too careful in patenting improvements upon his device. The Metz patent, for a bicycle pedal, claimed pintles having screw-threaded ends, the inventor intending to attach the pintles to the crankshafts by means of the screw-threaded ends without employing any of the old independent devices for holding them firmly in place. Before the granting of the Metz patent both the right-hand and the left-hand pintles were threaded with a right-hand screw-thread. Difficulty arose from the fact that the right-hand pintle was likely to become loose in the crank. Metz's idea was to master that difficulty by putting a left-hand screw-thread on the right-hand pintle and a right-hand screw-thread on the left-hand pintle, but, in practical operation, the tendency was to unscrew both pintles in the crankshaft arms. As a result of observation and experiment the inventor, after his patent was taken out, conceived the idea of reversing the screw-thread, and doing what had never been done before in connection with bicycle pedals, or, as far as shown, in any other art, by making a right-hand pintle with a right-hand thread, and a left-hand pintle with a left-hand thread. Automatic tightening of both pintles resulted by reason of the lost motion of the pintle in actual use, which tended to screw home both pintles. If the patentee had conceived that idea at the time of his patent, and had described it in connection with the other elements, or if the combination which he described had possessed the inherent capacity or function of accomplishing the new result, there would have been no doubt as to the validity of the invention. But the patentee did not describe such means, nor had he discovered these means at the time of the issue of the patent. The discovery was valuable. In view of the fact that the function of automatic tightening resulted from invention subsequent to the granting of the patent, through a rearrangement of the means described, the Court felt constrained to hold the Metz patent void.

Upon the application of Dr. Dadirrian, Judge Blanchard, of the New York Supreme Court, issued an injunction restraining William Hames from using the word "Matzoon," holding that the term was an arbitrary designation and a proper subject of a trade-mark, which is the exclusive property of the company. The defendant urged that the word was not fanciful, but descriptive of a food that has existed for years in Armenia and other Eastern countries known by the name of Madzoon or Maadzoon, being a species of fermented milk having the consistency of jelly or of cup custard, and that when in liquid form it was known as Taa; that it was first introduced into this country in 1885 by Dr. Dadirrian, and that through his efforts the article has a commercial value to-day. The judge adds that the question as to whether the word "Matzoon" is a proper subject of trade-mark has already been before the courts of this country, the federal courts holding that the word could not be appropriated as a trade-mark, and the courts of this State holding to the contrary.

In closing, Justice Blanchard says: "The equities of the case are with the plaintiff, and until the higher courts of the State hold otherwise I prefer to follow the decisions of the courts of this State."

Invention Changed by Assignee.—An agreement between the inventor of improvements in automatic air brakes and a railroad company, granting to the latter the license and right to use the invention, and equip their rolling stock in whole or in part with the same during the term of the patent, does not entitle the company to make important changes in the mode of constructing the brake and in using the brake so altered, especially if they use, and claim to use, it as the invention of such inventor.—MacLaughlin vs. Lake Erie & D. R. Ry. Co., 2 Ont. Law Rep. (Can.) 190.

Broadening Claims on Reissue.—The claims of a patent which has been in existence for ten years, during which time it has been before the courts in a number of cases, and construed and held valid, cannot be broadened by a reissue to cover structures which the courts had previously decided did not infringe; and particularly where such broadening of the claims eliminates the distinctive feature of the invention, upon which alone the validity of the original patent was sustained, and of which decrees for infringement were predicted. Troy Laundry Machinery Co., Limited, et al. vs. Adams Laundry Machinery Co. et al., 112 Fed. Rep. (U. S.) 437.

Combining Scientific Names.—After certain medicines have been discovered and named, and their effects on the health have been investigated, and the results of such investigation published to the world for several years, a manufacturer of a preparation for the same purpose could not adopt a combination of the names of such first-discovered medicines, and thereby prevent the use of such names, or a combination thereof, by other manufacturers of similar preparations. Searle & Hereth Co. et al. vs. Warner, 112 Fed. Rep. (U. S.) 674.

Usefulness of Invention.—The degree of utility of a patented article does not affect the question of patentability, nor does the length of time it will last and continue useful, but, if it is useful at all, that is sufficient to sustain the patent.

111 Fed. Rep. (U. S.) 916.

RECENTLY PATENTED INVENTIONS.

Hardware.

TRACE-FASTENER.—W. FREELAND, Brooklyn, N. Y. The object of the invention is to provide a spring catch, which, while cheaply constructed, will be so durable as to stand the hard usage to which it is necessarily subjected. The spring is fully protected from rough usage, and cannot be struck and broken, or jarred out of place. No rivet or oth fastening is required to hold it in place.

DOOR-LATCH.—I. D. BEACH, Marblehill, Mo. In this door latch a spring-pressed latch bar, a keeper-bar and a looped handle are all formed of the same piece of wire rod, and may be combined with a rockable tripping lever adapted to work the latch-bar.

SASH-FASTENER.—W. R. ABRAMS, Portland, Oregon. This invention relates to a device for fastening window sashes adjustably together. It comprises a bolt arranged to engage the sash and controlled by a peculiarly formed lever having connection with the bolt to throw it from one position to the other.

Machines and Mechanical Devices.

MACHINE FOR TURNING IRREGULAR FORMS.—A. LEHMANN, New York, N. Y. The invention provides a machine for automatically turning irregular forms, such as tobacco pipes. A work-holding frame carries the work against a rotary cutter. A model on this frame bears against a circular disk, to which it is held by a weight. The proper form is thus given to the work which must bear the same relation to the cutter as the form does to the disk.

CLUTCH.—J. TURNBULL, Dundee, Scotland. In this clutch the advantages of friction engagements are combined with those of a positive or non-slipping drive. The invention comprises two cones fitted to slide one upon the other, one of the cones being chambered and provided with grooves in its peripheral wall. A head fits into the chamber of the cone and is provided with pivoted and spring-pressed fingers engaging these grooves. The fingers are disengaged by a ring which can be operated to slide over and depress them.

DITCHING AND DREDGING MACHINE.—C. E. WILSON, St. Louis, Mo. In ditching, the earth is scooped up by buckets hung on a large wheel lying partly in the ditch. The wheel has along its periphery a crown-gear which engages a driving pinion. Each loaded bucket as it is carried to the dumping position strikes a latch which releases a chute and throws it laterally so that the load it receives will be discharged beyond the side of the wheel. In dredging, the machine is mounted on a suitable vessel, and, owing to the chutes which are tiltable to either side, the material may be conveniently dumped into scows lying alongside the vessel.

FEEDING MECHANISM FOR SEWING-MACHINES.—F. O. BERG, Spokane, Wash. The invention has for its object to provide a simple device operating to draw the stitched goods from the machine, thus leaving both hands of the operator free to feed the goods to the machine. This is done by mounting a pair of drawing rollers back of the needle, which are operated to hold the material taut.

ELEVATOR.—W. J. O'BYRNE, Catoosa, Indian Ty. The invention relates to an elevator in which buckets are employed on a traveling belt. Aprons are employed on each side of the buckets to prevent particles of stone or other material from falling between them and the belt.

RAISING AND LOWERING APPARATUS FOR MINES OR THE LIKE.—D. DAVY, Sheffield, England. The invention relates to continuously-running apparatus for raising and lowering in mines, and the improvements aim to allow longer pauses to be made by the cages at the top and bottom landing stages, for the purpose of affording more time for loading and unloading without interrupting the movement of the chains and their driving gear. The cages are suspended from slings attached to the chains. On reaching a landing point, each cage is set down and detached from the sling by which it was brought to that point, and after remaining there at rest, while the chains travel a distance equal to that between two consecutive slings, the cage is picked up again by the next succeeding sling of the series, carried to the next landing point and there deposited, to be picked up again by the next sling.

TYPEWRITER.—J. B. VIDAL, Havana, Cuba. The improvements are made in the keyboard which aim to facilitate rapid writing. The outer keys for each hand are slightly higher than the middle key, so that the little finger, thumb and other short digits, can reach the keys with as little effort as the long finger. For the fingers that are not much used, and therefore clumsy to manipulate, the keys are provided on one or more sides with L-shaped guides.

MANTLE-TRIMMER.—C. WAGNER and W. WENDTLAND, New York, N. Y. The machine comprises a set of knives operating in conjunction with a mandrel for trimming the tubular fabric, one set of knives being arranged to advance and cut a portion of the fabric, and then recede a little to hold the latter in position, while the other set advance and cut the remaining portion of the fabric.

MACHINE FOR PREPARING PAPER FOR STEREOTYPE MATRICES.—R. M. SEVERS, New York, N. Y. The machine comprises a frame and a pot for holding a liquid adhesive in which a number of independent rollers are journaled for the purpose of carrying moving webs of paper through the adhensive. Pressure-rollers are provided for squeezing the webs together, and separate rollers feed dry webs of paper above and below the immersed webs arriving from the pot. The product is then cut by a cutting mechanism near the pressure-rollers.

Railway Contrivances.

CAR-COUPLING.—W. H. CORDILL, Grand View, So. Dakota. The object of the invention is to provide a device whereby a train of cars may be uncoupled at any desired point by turning the line of rods from either end of the train. The coupling-heads are placed inside a cylindrical draw-head provided with arms extending outwardly and forwardly, each draw-head being automatically locked to the cylinder of an opposing draw-head. When the rods connecting the couplings are turned, the coupling-heads are unlocked, thus disconnecting the car. By the turning of the rods the coupling-heads of a train are, one after another, brought under the control of the operator until the coupling is reached which is to be disconnected. Thereupon a single turn of the rod in the opposite direction unlocks this coupling and all the coupling-heads on the rod will be simultaneously returned to their initial positions.

MEANS FOR PROVIDING BRAKES TO RAILWAY VEHICLES.—J. BOWMAN, Petersburg, So. Australia. The invention is devised to provide a simple, but inexpensive arrangement for the combination of independent brakes, with a continuous and simultaneous action in railway trains, so that in the event of an accidental division of the train, the brakes are automatically applied. The brakes which are normally down are connected with the draft-rod; therefore, when it is desired to move the train it will not be necessary to lift the brakes of each truck separately, but the engine will be operated to put tension on the draft-rod of each car, thus lifting the shoes from the wheels. In going downhill or stopping, the tension on the draft-rod will be released, and the shoes will spring back onto the wheels.

LOCOMOTIVE FRONT-END COUPLING GEAR.—J. F. DUNN, Salt Lake City, Utah. Effective mechanism is provided for automatically locking the coupler in elevated position so that the accidental collapse of the coupler will not be possible. The coupler is held up by toggle arms which are operated by a piston in a fluid-cylinder. A bolt, lifted by the tension of a spring, locks the toggles in place. This bolt is so connected with the fluid-cylinder that when fluid-pressure is applied, it will first withdraw the bolt and will then act on the piston of the cylinder to break the toggle and move the coupler down.

Miscellaneous Inventions.

WASHBOARD.—W. H. MANEY, Franklin, Tenn. The washboard is curved about a longitudinal axis, the radius of the curve corresponding to the ordinary washtub, so that when placed in the tub the washboard will lie close to the operator. The central trough causes the water and suds to flood the clothes better and drains the water away from the sides.

SCRAPER.—D. E. PRESTON and W. H. ATKINSON, Omaha, Neb. The scrapers are used in pigs'-feet-cleaning and aim to effectively and quickly clean pigs' feet, pigs' heads and like articles, without requiring subsequent trimming with the knife, and without danger of cutting the article.

CHUTE.—W. L. MCCABE, Tacoma, Wash. This invention relates to means for delivering goods by gravity along an inclined chute into the hold of the vessel, and aims to regulate the descent of the goods, so as to avoid dropping them rapidly down the incline. This end is attained by providing brake-boards which run longitudinally along the chute and may be pressed with any desired degree of force against the article which is sliding along the bottom of the chute.

QUILTING FRAME.—B. F. MURRAY, Cleveland, N. C. The quilting frame can be quickly adjusted for use, conveniently used for quilting, and compactly folded when not in use.

COMPOSITE MATERIAL.—E. C. HEGAN, Louisville, Ky. The composite material consists essentially of two layers of veneer cemented together by a coating of gypsum. The material may be bent in tubular form and used for columns in the manufacture of furniture and the like, plugs of wood being secured in the ends of the tube, and each plug formed with a central dowel pin for fastening the column in place on the piece of furniture.

WASTE-WATER RECEPTACLE AND DISCHARGE-TRAP FOR ICE-BOXES OR THE LIKE.—J. J. HICKEY, New York, N. Y. The invention provides a simple and practical means for catching waste-water that escapes from the lower portion of an ice-box. A box like receptacle is held on the lower side of the ice-box, and an escape pipe depends from the ice-box into this receptacle. A cup covers the end of this escape pipe, which affords a water seal to prevent foul air from entering the ice-box. The water passes through a nipple in the bottom side of the receptacle, into a U-shaped trap and thence to the sewer.

WASTE-WATER RECEPTACLE AND CONNECTION.—J. J. HICKEY, New York, N. Y. The waste-water receptacle has an opening in its bottom wall through which the water escapes. A screen covers the opening, comprising a cylindrical wall having openings therein and a series of tapered tongues on the upper end, which are bent inwardly to close the end.

CHAIR-TRUCK.—R. and F. E. BIGELOW, Vanwert, Ohio. The invention consists of roller attachments or wheel supports for rocking-chairs used by invalids. The truck is composed of two wheels and two axle sections which are adjustable lengthwise upon each other and provided with depressions adjacent to the wheels for receiving the chair rockers.

FACE PROTECTOR.—MARY LONGDEN, St. Oswalds, Ballingary, Ireland. The invention aims to protect persons who are exposed to the danger of inhaling poisonous gases, smoke, etc. The face protector comprises a body of flexible material having a central opening, and above the same a nose strap provided with a flexible piece of metal which is adapted to conform closely to the nose. Pieces of wire netting cover the opening and hold a sponge therein.

MEDICINE-APPLICATOR.—B. A. WASHBURN, Wickliffe, Ky. The instrument is used for applying medicine to the vagina. It comprises a tube adapted for insertion in the vagina and open at the insertable end, a cup-like medicine holder which is adapted to slide in this tube and a plunger which is operated to force out the medicine.

SCREEN FOR PAPER PULP.—S. H. TIBBETTS, Groveton, N. H. The invention comprises a means for fastening screen-plates in the cradle of a paper-pulp screen, without the aid of screws. A series of cross-bars having undercut notches, are placed in the bottom of the cradle. To these the screens are secured by retaining-bars having trunnions which fit the notches in the cross-bars, and having also overhanging upper edges which grip the lips on the under surface of the screen-plates.

TIRE.—MARY E. BROOKE, Denver, Col. The tire consists of a core having a solid tread with transverse disks or lugs spaced apart, and a casing fitting over the core. The inner lining of the casing is pressed partially into the spaces, the disks overlapping their edges, and bracing them against displacement. When applied to the wheel, the tire may be secured by a tie-rod passing through openings in the disks along the inner periphery of the tire.

ROD-SWAB.—J. O. DAUPHIN, Rat Portage, Canada. The invention aims to provide a device for effectually wiping rods which move through stuffing boxes. It consists of a circular case formed in two sections hinged together, and adapted to contain a swab. A circular spring passes around the swab, and holds it properly in engagement with the rod. The casing is arranged to be fastened to the stuffing box bolts.

MAIL CATCHER AND DELIVERER.—J. F. MILLS, JR., and C. F. FREMD, Port Chester, N. Y. In this invention two corresponding devices are used, one on the car for catching the mail-bag suspended near the track, and the other placed near the track for catching the mail-bag suspended on the car. The devices are so constructed that the moment a bag is brought into engagement with the open gripping arms, they will instantly close, and hold the bag until purposely released. At the same time the gripping mechanism will automatically turn to a position parallel with the track.

FLIER.—J. J. MCOSKER, Woonsocket, R. I. The flier is so arranged that it is much easier and cheaper to construct than those heretofore used and may be driven at a high speed so as to wind the yarn rapidly and perfectly.

METHOD OF FILLING PRESERVE-BOXES.—E. BESSE and L. LUBIN, Paris, France. The tins are first filled with the solid portion of the foodstuff. They are then submerged in an air-tight compartment filled with the liquid which is to form part of the preserve. An air-pump exhausts the air from the compartment and the tins, and the liquid flows into the tins as soon as the air re-enters the compartment. The hole in the cover is then closed by a drop of solder.

FEED-BAG.—G. L. DALE, New York, N. Y. Means are provided in this feed-bag for controlling the supply of feed to the animal. In the ordinary feed-bag the food, when partly consumed, is aggravatingly out of reach of the animal. This causes a series of frantic efforts to reach the food, such as tossing the head in order to catch the food "on the fly," resulting in considerable waste. In the improved feed-bag the oats are delivered gradually from a reservoir, by valve devices operated by the jaws of the animal while feeding.

EASEL.—C. P. MUELLER, Dallas, Texas. This easel is so arranged that the drawing-board may be readily raised and lowered or otherwise adjusted at will to suit the convenience of the artist.

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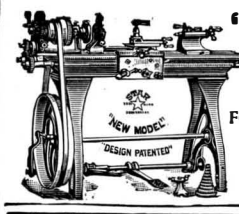

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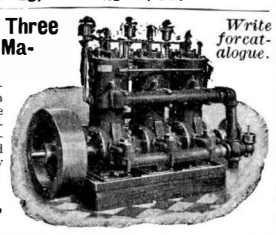

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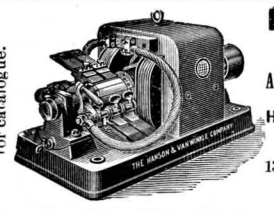

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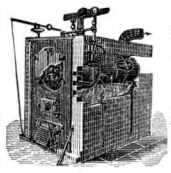

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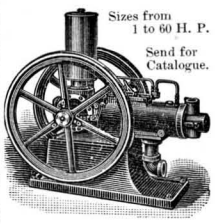

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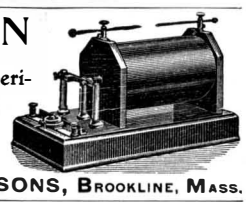

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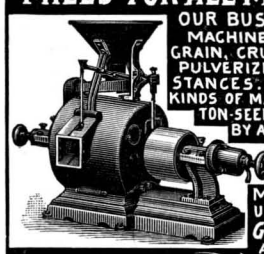

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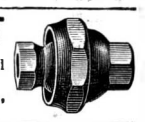

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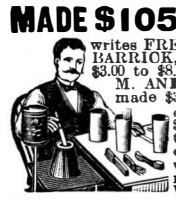

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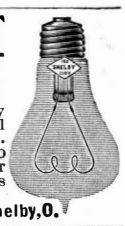

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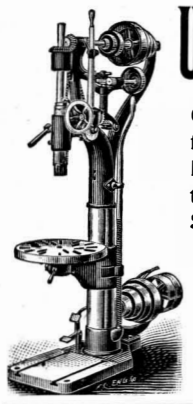

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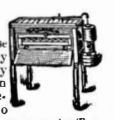

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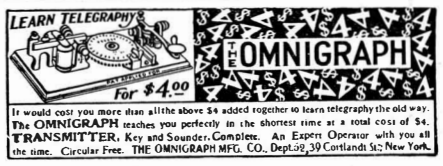
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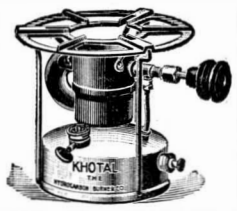

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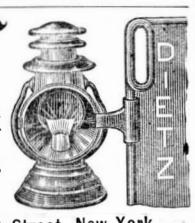

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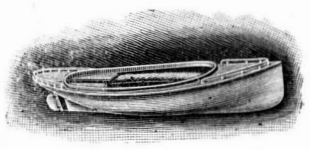

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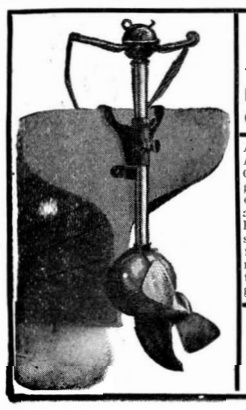

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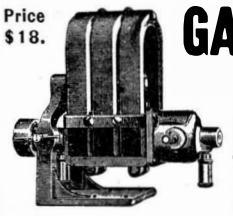

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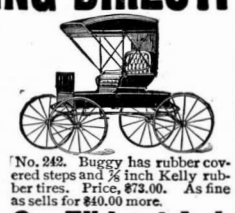

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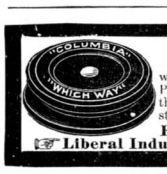

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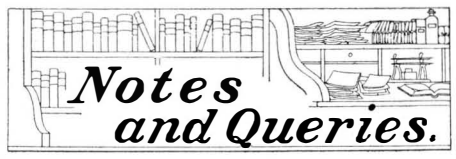

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(8577) G. W. H. asks: How can I connect the wires on the carbon element of an open circuit, home-made battery which I have? I use sal ammoniac. They work fine for about two weeks, when I have to renew connections on the carbon. It seems the fluid rises within the carbon and corrodes the wire. Have tried paraffine and also rubber on the outside, but to no avail. The carbons are arc-light pencils, well up out of the fluid. A. Dip the tops of the clean and dry carbons into melted paraffine till they are saturated with the paraffine as far as the surface of the liquid, so that the sal ammoniac cannot climb through the carbon, nor over the outside of it. In sal ammoniac cells usually there is a thick head of composition on the upper end of the carbon.

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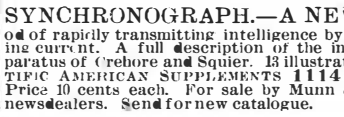

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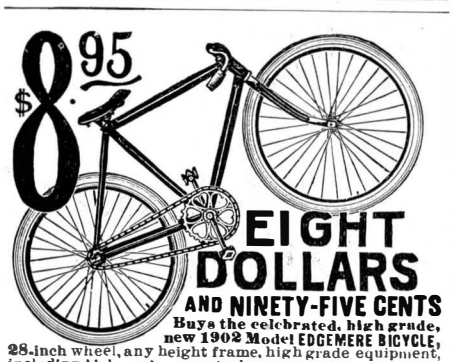

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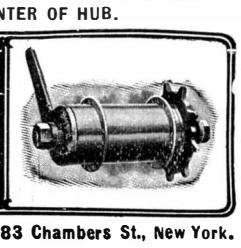

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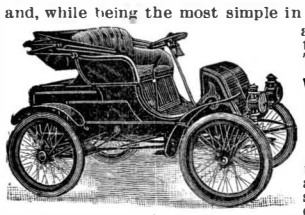

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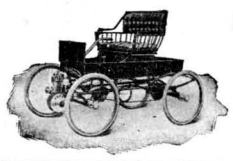

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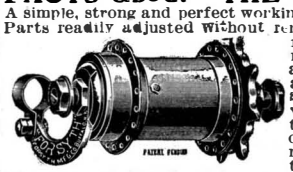

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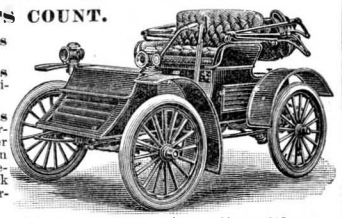

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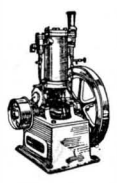

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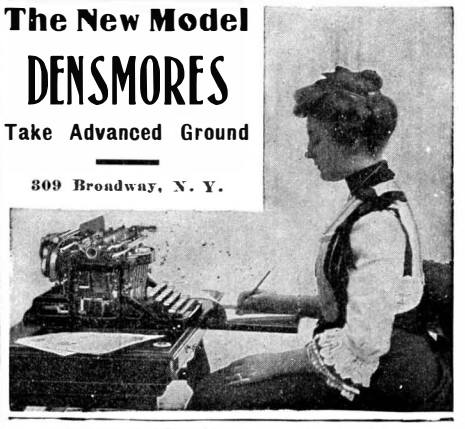

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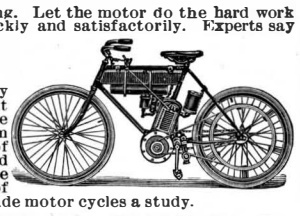

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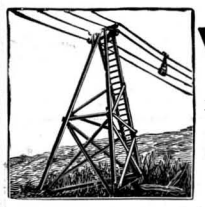

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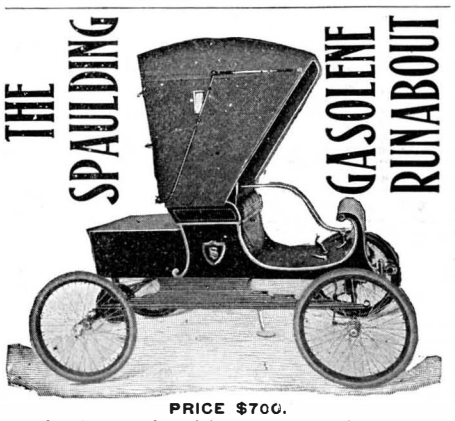

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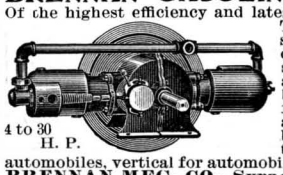

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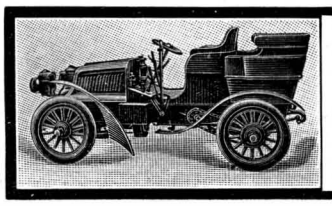

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